HNSCC is feasible while respecting strict dose constraints to OARs. By correcting for morphological and biological tumor changes during RT, higher conformity is ensured between the FDG uptake and the dose distributions. Clinical studies must be conducted to evaluate the acute and chronic toxicities and the tumor response of such a strategy.

PO-0647
Target-selective radio-sensitization in head and neck tumors by the novel HYPERcollar3D hyperthermia applicator
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Purpose/Objective: Current treatment of advanced cancer of the head and neck is unsatisfactory in terms of outcome and the toxicity of current treatments are severe. Phase III clinical trials have shown that hyperthermia (heating in the range of 40-44°C for one hour) is a potent sensitizing agent of radiotherapy, which is achieved without additional toxicity [1-3]. To enable heat-sensitization also in target regions at deep locations, we developed the HYPERcollar and showed in 45 patients that inducing hyperthermia in tumors located deeply and laterally in the head and neck region is feasible and has potential. Over the years, we further introduced an adaptive hyperthermia strategy based on electromagnetic field simulations. In this study, we analyze the HYPERcollar3D that is a redesigned version of the HYPERcollar aimed at improving heating quality, heating reproducibility and patient comfort.

Materials and Methods: In the HYPERcollar3D, patient comfort and treatment accuracy/stability are improved by splitting the waterbolus functions into a stable outer part and a patient conformal inner part. Patient positioning according to the CT resembles that of radiotherapy and is obtained by immobilization and a laser alignment procedure. Based on a mechanical redesign, we performed parameter studies using electromagnetic simulator SEMCAD-X (v. 14.8.6) to investigate further improvement by increasing the number of antennas and their locations.

Results: The simulation studies showed that higher number of antennas, and their repositioning, allows for a substantially improved treatment quality. All improvements combined enable a predicted reduction of hotspot importance prominence (hot-spot target quotient (HTQ)) by 32%. Combining all systems improvements, simulations predict that a doubling of the clinically applied power to the target can be achieved. After clinical introduction, two patients (nasopharynx ca. and a neck node metastasis) have been treated with the HYPERcollar3D. Validation of heating performance by invasive thermometry in the tumor proved not possible but, in both patients, the scheduled treatments of 75 minutes could be completed using a mean applied power of 350-400W. In addition, the estimated SAR based on the realtime measured powers/ phases of the signals was 90W-200W/kg, which is beyond the long term average applied SAR using the conventional HYPERcollar, i.e. 75W/kg.

Conclusions: Although the improvement still has to be validated by invasive temperature measurements in the tumor, these results are very reassuring that the HYPERcollar3D will provide a significant improvement in treatment quality. Hyperthermia is currently used as a standard addition to radiotherapy for patients that are re-irradiated. A protocol for a clinical study in primary tumors is being finalized.

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PO-0648
Patterns of long-term swallowing dysfunction after definitive radiotherapy or chemoradiation
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Purpose/Objective: To identify patterns of long-term, radiation-induced swallowing dysfunction after completion of definitive radiotherapy with or without chemotherapy (RT or CRT) and to determine which factors could explain these patterns over time.

Materials and Methods: The study population consisted of 238 consecutive head and neck cancer patients treated with RT or CRT. The primary endpoint was ≥ grade 2 swallowing dysfunction at 6, 12, 18 and 24 months after treatment. Cluster analysis was used to identify different patterns over time. The degree of swallowing dysfunction at baseline and at all subsequent time points (at 6, 12, 18 and 24 months) were considered for cluster modeling on the basis of their contribution to characterizing the patterns of late radiation-induced swallowing dysfunction. The differences between the dose-volume histograms (DHVs) of the swallowing organs at risk for each pattern were determined by using dose maps.

Results: The cluster analysis revealed five patterns of long-term, radiation-induced swallowing dysfunction: low persistent, moderate persistent, severe persistent, transient and progressive (Figure 1). Patients with high dose to the upper pharyngeal, laryngeal and lower pharyngeal region had the highest risk of severe persistent swallowing dysfunction.
Transient problems mainly occurred after high dose to the laryngeal and lower pharyngeal regions, combined with moderate dose to the upper pharyngeal region. The progressive pattern was mainly seen after moderate dose to the upper pharyngeal region.

Conclusions: After definitive RT or CRT, five different patterns of swallowing dysfunction can be identified over time. This could reflect different underlying radiobiological mechanisms of radiation-induced damage and recovery. These results may improve identifying patients who are at the highest risk for developing severe persistent swallowing problems and who may benefit most from different preventive measures, such as swallowing sparing IMRT.

PO-0649
Total mucosal irradiation for head and neck cancer of unknown primary: a combined analysis of 2 prospective studies
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Purpose/Objective: Head and neck carcinoma of unknown primary (HNCUP) metastatic to cervical lymph nodes (LN) constitutes about 2% of all head and neck carcinomas. There is no consensus on a standard radiotherapy clinical target volume (CTV) (ipsilateral neck only vs bilateral neck and mucosal tube) or dose to the CTV (50-70Gy). The aim of this combined analysis was to assess the safety and feasibility of total mucosal and bilateral neck intensity modulated radiotherapy (TM-IMRT).

Materials and Methods: We performed a combined analysis of 2 single arm, phase 2 prospective trials (CCR2823 and CCR3301). All patients (pts) had PET-CT or CT staging, pan-endoscopy and tonsillectomy or biopsy to exclude an occult primary. Patients with stage T0, N1-3, M0 (AJCC TNM 2002) disease were treated using a 5- to 7-field IMRT technique. CTV1 was the ipsilateral level 1b-5 and retropharyngeal (RP) LNs. CTV2 was the mucosa of nasopharynx, oropharynx, larynx, hypopharynx and contralateral cervical level 2 to 5 and RP LNs. Prescribed doses to PTV1 and PTV2 in 30 fractions were 60-65 Gy (depending on resection status R0 - 60Gy, R1/R2 - 65 Gy) and 54 Gy, respectively. No prophylactic enteric feeding tubes were inserted. Results: Thirty-six pts (53% male) with HNCUP, median age of 54.2 years (range 43-86.9 years), were treated between July 2007 and December 2012. Histology was squamous cell carcinoma (SCC) in 35 pts or undifferentiated carcinoma nasopharyngeal type in 1 pt. Twenty-five (69%) pts were p16-positive (surrogate for HPV) and 18 (50%) pts had a ≥10 pack year smoking history. Eighteen (50%) pts received chemoradiotherapy with concomitant platinum and 18 (50%) pts radiotherapy (RT) alone. The median treatment time was 41 days (range 39-46 days). All pts received the prescribed dose with no clinically significant delays. The 2 year locoregional control rate was 89.8% (95% CI, 78.4-100). The 2 year primary mucosal and local nodal control rates were 97.1% (95% CI, 91.4-100) and 89.8% (95% CI, 78.4-100) respectively. One mucosal primary (oropharynx) was detected 7.3 months (m) after RT and 2 patients died from recurrent metastatic SCC at 5.7m and 16.4m after RT. Twelve pts (33%) had acute (<3m after RT) grade 3 (LENT-SOMA) dysphagia. The 1 year enteric tube feeding rate was 1 of 36 (2.7%) pts. Rates of high grade, subjective xerostomia (LENT-SOMA, ≥grade 2) at 12m and 24m after RT were 17% and 15% respectively. Conclusions: At a median follow up of 33.5 months the use of TM-IMRT treating the total mucosal tube to an elective radiation dose of 54 Gy was associated with good local control rates. Toxicity is improved compared to previously reported TM-IMRT regimens encompassing similar mucosal volumes.

PO-0650
Dynamics of tumor hypoxia in serial 18F-Misonidazole PET for SCCHN during chemoradiation and correlation to outcome
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Purpose/Objective: Tumor hypoxia is a common feature of locally advanced head and neck cancer (HNSCC) that is associated with higher malignancy and increased radioresistance. The resolution of tumor hypoxia during fractionated radiation treatment is assumed to be pivotal for treatment success. 18F-fluoromisonidazole PET (F-MISO PET) allows noninvasive assessment of hypoxia during treatment. The purpose of the present study was to noninvasively assess the time course of tumor hypoxia and its correlation with additional imaging modalities and outcome.

Materials and Methods: A prospective serial imaging study was conducted in patients undergoing definitive radiochemotherapy (RCTs, total dose 70Gy) for locally advanced HNSCC, accompanied by Cisplatin in weeks 1, 4 and 7. Tumor hypoxia was assessed by F-MISO-PET by static scans, response on MRI scans (complete reponse (CR), partial...