

to Kaplan-Meier method, 5-year locoregional control (LRC), ultimate locoregional control (uLRC), disease-free survival (DFS) and overall survival (OS) were 41%, 46% 31% and 30% respectively. In univariate analysis gender, anamnesis duration and N-status significantly influenced LRC, uLRC and DFS, also dHb was significantly correlated with LRC and uLRC, and additionally, T-status was related to uLRC. Overall survival was significantly related to gender, dHb, T-, N-status and Vn. In multivariate analysis dHb and T-status remained significantly related to uLRC while dHb, N-status and Vn remained significantly related to OS.

Conclusions: Unlike locoregional cure, depending more on primary tumor related factors, overall survival correlates with nodal involvement. Decrease in hemoglobin concentration during RT significantly deteriorate outcome of patients with hypopharyngeal cancer.

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2556 Tongue Strength and Swallowing Dysfunction in Head and Neck Cancer Patients after Radiation Therapy

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Purpose/Objective(s): High dose radiotherapy (RT) and chemotherapy have been utilized as primary treatment for tumors of the oral cavity and oropharyngeal to preserve organ function. RT to the oral cavity and oropharynx can cause changes in swallowing resulting in reduced ability to propel foods and liquids through the oral cavity and pharynx. Oral phase impairment can include reduced bolus formation, impaired bolus transport through the oral cavity, prolonged oral transit times, and increased oral residue percentages. The exact mechanism of oral phase impairment is unclear, but tongue strength may play an important role in swallowing dysfunction in these patients. This study examined lingual strength in patients treated with primary RT +/- chemotherapy for head and neck cancer.

Materials/Methods: 13 patients treated with radiotherapy +/- chemotherapy for head and neck cancer consecutively referred for Modified Barium Swallow (MBS) Assessment participated. Median age was 61 years (range 47-79). Primary sites included nasopharynx (n = 4), oropharynx (n = 4), larynx (n = 3), hypopharynx (n = 2). Time from RT to MBS evaluation was 2 months to 15 years. All subjects underwent MBS and tongue strength testing with Iowa Oral Performance Instrument (IOPI). Identification of lingual disorders of swallowing (oral and pharyngeal tongue) was made for each swallow for each subject from MBS evaluation. Maximum tongue strength (kPa) was assessed, using IOPI, over 3 trials, with best trial taken as maximum.

Results: Median tongue strength was 32 kPa (range 7-57). All patients exhibited impaired maximal tongue strength as compared to healthy normal individuals (defined as 60 kPa), as assessed with IOPI. Twelve of 13 (92 %) patients exhibited impaired tongue base function for swallowing, based on MBS evaluation. One of 13 (8 %) patients exhibited oral tongue impairment for swallowing.

Conclusions: These data suggest that RT +/- chemotherapy for head/neck cancer frequently results in tongue strength impairment. This decrement in strength is likely due to lingual tissue fibrosis. These data provide support for providing tongue strength exercise programs to those patients undergoing radiotherapy to the head and neck, regardless of primary tumor site, for those patients undergoing radiotherapy that includes the tongue and neck(s) in the treatment volume.

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2557 Construction of a Dental Atlas for Automatic Teeth Segmentation to Improve Post-irradiation Dental Care Management

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Purpose/Objective(s): The risk of post-extraction osteoradionecrosis or implant failure following irradiation of the head and neck (HN) is currently assessed on rough estimates of dose to bone from retrospective dosimetric data. In the absence of prospective delineation and dosimetric assessment, dose distributions are poorly predictable with IMRT/tomotherapy/stereotactic radiotherapy compared to 2D RT. Manual delineation of mandibula, maxilla and teeth is time-costly and basically impossible in routine practice. A dental atlas was built and its ability to provide accurate segmentations of the dental structures in order to generate tooth-by-tooth dose-volume histograms was assessed.

Materials/Methods: 2.5-5mm CT data of 12 HN dentate cancer patients (less than 6 teeth missing and few artifacts) were used. A radiation oncologist manually contoured the maxilla, mandibula and teeth + target and critical structures. Each image and its associated manual segmentation were symmetrized so that 24 manually delineated images were available. The leave-one-out atlas construction method was used for atlas evaluation: each paired image was successively picked out from the database. A symmetrical average atlas and its associated segmentation were constructed from the 22. Guimond's algorithm (2000) was used for average image construction. Average segmentation used an improved majority vote rule on 22 multilabel segmentations normalized onto the average image. Morphological post-treatment rendered average dental contours contiguous. This atlas was then deformed on the excluded image to get automatic teeth delineations on this image, and compare them to manual segmentation.

Results: Global teeth size and position were well-estimated using automatic delineation. Main differences between manual and automatic contours were due to intrinsic anatomical variability. Morphological post-treatment improved segmentation accuracy (measured by Dice index and Hausdorff distances) and reduced over-segmentation. However, segmentation accuracy was better for upper than lower teeth. Assuming a worse-case scenario, the maximal dose to a particular tooth was considered representative of the dose to the root. Dose estimates on retrospective dosimetric data or manual delineation were compared with doses estimated using the atlas. Atlas-based dental contouring led to moderate oversegmentation, which may slightly overestimate the risk of dental complications if dental extractions are needed after irradiation and thus favoring conservative dental management.

Conclusions: The dental atlas built as described provided slightly oversegmented teeth. However dose estimates using the atlas seemed more relevant than retrospective data collection.

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2558 Salivary Gland Tumors: Retrospective Review of the BCCA Experience from 1999 to 2008

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Purpose/Objective(s): To undertake an exploratory review of the BCCA experience with malignant salivary gland tumors (SGTs) diagnosed between 1999 and 2008.

Materials/Methods: The Cancer Agency Information System (CAIS) was queried for malignant SGTs of the major salivary glands diagnosed between Jan. 1, 1999 and Dec. 31, 2008. A retrospective chart review of all cases referred to the BCCA was also performed. The data that was collected included histological subtype, stage at diagnosis, surgery type, pathology (grade, LVI, perineural invasion and margin status) and radiation treatment.

Results: A total of 372 cases of SGTs were diagnosed in BC from Jan.1, 1999 to Dec. 31, 2008. There were a total of 27 different histological subtypes coded in CAIS. The three most common subtypes were acinic cell carcinoma (21.0%), mucoepidermoid carcinoma (15.5%) and adenoid cystic carcinoma (11.0%). 325 (87%) cases were referred to a cancer centre within BC. Of the referred cases, over 80% of patients had surgery, 70% received radiation (55% adjuvant and 15% were radiation alone) and only 5% received immediate chemotherapy. 65% of the cases were male and the average age was 60 yrs. The distribution of cases by stage was 33% with stage I, 23% stage II, 13% stage III and 27% stage IV. A preliminary analysis at a median follow-up of 30 months showed a median survival for all patients referred to be 75 (\pm 5.05 95% CI) months. Overall survival at 5 years was 60%. For each stage it was 91% for stage I, 97% for stage II, 52% for stage III and 26% for stage IV.

Conclusions: The main subtypes of malignant SGT in our series were acinic cell carcinoma, mucoepidermoid carcinoma and adenoid cystic. The main treatment is surgery with or without adjuvant radiation. Survival for patients with early stage disease is excellent and this decreases with increasing stage. Further analysis to look at the effect of primary treatment, histological subtype, grade, margin status and other factors is ongoing.

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2559 Factors Associated with Distant Metastasis in Squamous Cell Carcinoma of the Head and Neck Treated with Definitive Radiation Therapy: The UAB Experience

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Purpose/Objective(s): We report on our experience and identify risk factors for distant metastasis (DM) in a large series of patients treated with definitive radiation therapy for squamous cell carcinoma of the head and neck (SCCHN).

Materials/Methods: The records of patients treated at the University of Alabama at Birmingham between 1995 and 2007 who received definitive radiotherapy (RT) with or without concurrent systemic therapy for SCCHN were reviewed. After excluding nasopharyngeal, sino-nasal, and unknown primary carcinomas, patients <18 years of age, or those with prior history of cancer, 560 patients were available for analysis. Development of distant metastasis was recorded, and distant metastasis-free survival (DMFS) was calculated using the Kaplan-Meier method. Clinicopathologic, demographic, and treatment factors were assessed for association with DMFS via univariate analysis. Potential prognostic factors from the univariate analysis were then further analyzed in a Cox regression multivariate model.

Results: With a median follow-up of 26 months, 56 patients (10.0%) developed distant metastasis. Two-year actuarial DMFS was 89%. Factors significantly associated with lower DMFS on univariate analysis included hypopharyngeal primary site ($p = 0.03$), higher T-stage ($p = 0.006$), higher N-stage ($p < 0.001$), and locoregional recurrence (LRR; $p < 0.001$). On multivariate analysis, only N-stage and LRR remained significant predictors ($p < 0.001$ for each). No subgroup identified had a higher rate of DM than LRR. The majority of initial metastases were to lung, while other sites (bone, skin, liver, brain, gastrostomy site) accounted for <25% of cases. Median survival after diagnosis of metastasis was 5 months (range: 0 - 86 months).

Conclusions: This large, retrospective series highlights the importance of locoregional control in DMFS in SCCHN. Efforts to improve local therapy should thus be emphasized. Lung is the dominant site of metastasis, but other sites may warrant clinical attention during follow-up. Survival after metastasis is generally poor.

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2560 Risk of Cervical Esophageal Stricture with Intensity Modulated vs. Conventional Radiation Therapy for Head and Neck Cancer: A Systemic Review

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Purpose/Objective(s): Intensity-modulated radiation therapy (IMRT) has become an established treatment for head and neck cancer. Concerns remain regarding late toxicity, particularly treatment-induced cervical esophageal strictures with IMRT. The purpose of our study was to review the risk of esophageal stricture in patients with head and neck cancer after treatment with IMRT or conventional radiation therapy (CRT) and to compare the reported esophageal stricture incidence of prospective and retrospective studies.

Materials/Methods: An electronic PubMed search of cervical esophageal strictures after head and neck cancer radiation therapy was performed. The search was restricted to human clinical studies published in English language. Full text papers were examined