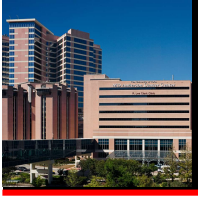


Changes in Sleep Apnea-Related Structures Following Radiation Therapy in Oropharyngeal Cancer Patients

Rishabh Gaur[1], Sam Mulder[2], Trevor Abts, Robert Aghoghovbia, Kyle Spier, Sydney Thomas, Irin Luke, Ahmed Tayloun, Clifton David Fuller MD PhD[2]

[1]University of Missouri-Kansas City School of Medicine, [2]The University of Texas MD Anderson Cancer Center

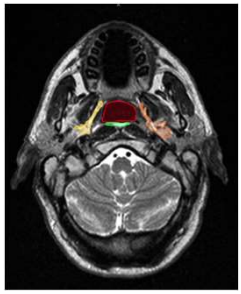
THE UNIVERSITY OF TEXAS MD Anderson Cancer Center

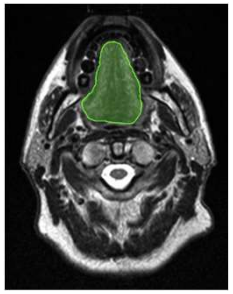
Introduction

- Head and neck cancer (HNC) patients often undergo radiation therapy (RT).
- Improvements in RT such as intensity-modulated radiotherapy (IMRT) have led to lower collateral damage, but radiation toxicity still impairs quality of life.
- Radiation can induce soft tissue swelling and inflammation which can cause airway obstruction.
- This can cause an often-overlooked side effect, sleep apnea.
- RT side effects can lead to disruption in therapy, which can lead to a higher chance of cancer progression, recurrence, metastasis, or second primary malignancy.
- There is limited research on the effects of RT on sleep outcomes and on the use of imaging biomarkers to monitor radiation toxicity during treatment for HNC.
- We will analyze anatomical changes related to sleep apnea over longitudinal patient scans.

Methods

- We used a retrospective cohort of HNC patients who have completed RT and have longitudinal MRI and CT scan data available post-RT.
- Patient-reported outcomes (PRO) were also collected for sleep disturbances, drowsiness, and fatigue.
- We performed manual segmentation of structures pertinent to airway patency and sleep apnea-related soft tissue changes on MRIs of 9 patients.
- Dixon-derived fat fraction (FF) imaging was acquired before and after RT during the same acquisition as the anatomical T2 MR sequence used for manual segmentation.
- FF maps were resampled to leverage implicit registration of images being acquired at the same setup.
- Difference from baseline FF for each anatomical structure was computed and assessed using the Wilcoxon Signed Rank Test.





Figures 1-2: Segmented Structures (pharyngeal airway, red; left/right posterior parapharyngeal space, orange/yellow; posterior pharyngeal soft tissue, bright green; tongue; green)

Results

- All patients were diagnosed with OPC and treated with standard fractionation RT 70 gray (Gy)
- Each of the segmented structures showed an increase in median FF intensity from before to after RT.
- The FF of the right posterior pharyngeal space, oral tongue, base of the tongue, and pharyngeal airway showed statistically significant increases ($p<.05$).
- PRO toxicities relating to sleep were assessed, but conclusions are currently limited given the low sample size.

Figure 3: FF Distributions Within Sleep Apnea-Related Structures Before and After RT

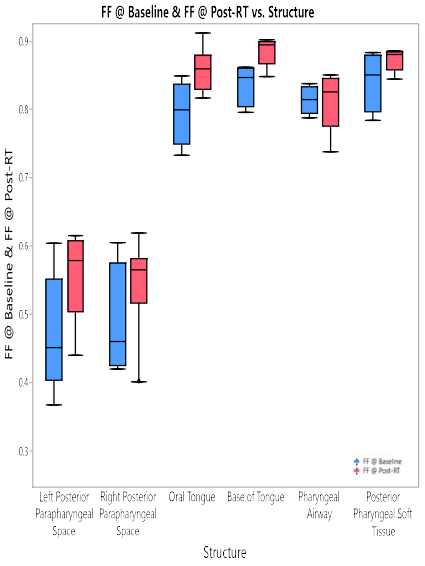
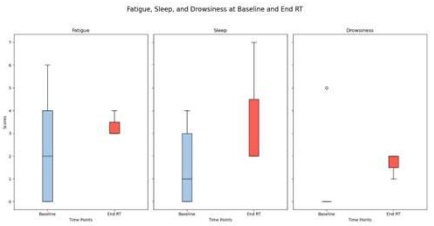


Table 1: Change in FF Distributions Within Sleep Apnea-Related Structures Before and After RT

Structure	Mean FF Difference (Post-RT – Baseline)	Wilcoxon S Value	P-value
Left Posterior Pharyngeal Space	0.09835	11	0.0781
Right Posterior Pharyngeal Space	0.10815	12	0.0469
Oral Tongue	0.41644	14	0.0156
Base of Tongue	0.43944	13	0.0313
Pharyngeal Airway	0.38102	14	0.0156
Posterior Pharyngeal Soft Tissue	0.49019	8.5	0.0938

Figure 4: Patient-Reported Fatigue, Sleep Disturbances, and Drowsiness at Baseline vs End of RT



Conclusions

- Our study suggests that Dixon-derived fat fraction intensity increases in tissues of the head and neck during RT.
- Identifying the anatomical correlates of sleep apnea-related toxicity can improve management and mitigation strategies for HNC patients undergoing RT.
- Our further research will involve increasing the sample size to include more patients' segmentations.
- We will correlate data from these segmentations with patient-reported fatigue, drowsiness, and sleep scores to better integrate advanced imaging with detailed symptom assessments and identify patients at highest risk of developing sleep apnea based on baseline characteristics.
- Identifying patients at high risk of RT side effects and real-time monitoring of side effects can inform clinical practices and interventions to reduce the burden of treatment-related toxicities and avoid disruptions in therapy.

Acknowledgments

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