Oncospace™ Risk Prediction Model for Radiation Toxicities: Novel Insights to Reduce the Risk of Radiation-Induced Xerostomia in Head and Neck Cancer Patients

Xuan Hui, Harry Quon, Scott P. Robertson, Zhi Cheng, Joseph A. Moore, Michael Bowers, Brandi R. Page, Ana P. Kiess, Todd R. McNutt

Johns Hopkins Sidney Kimmel Comprehensive Cancer Center, Department of Radiation Oncology and Molecular Radiation Sciences, Johns Hopkins University

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Purpose/Objectives

Background

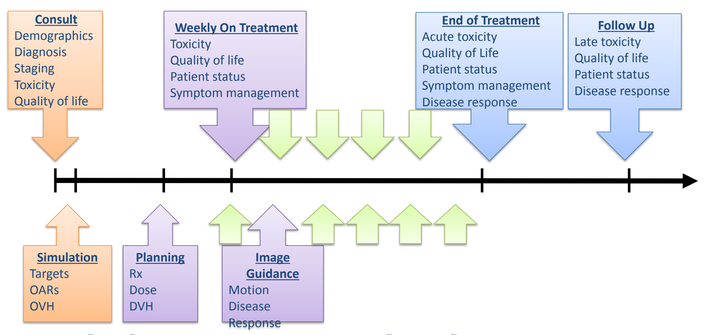
- Radiotherapy is a **major** component of the management strategy for local or regionally advanced head and neck cancer
- Irradiation of surrounding normal tissues commonly occurs, leading to radiation-induced xerostomia

Objectives

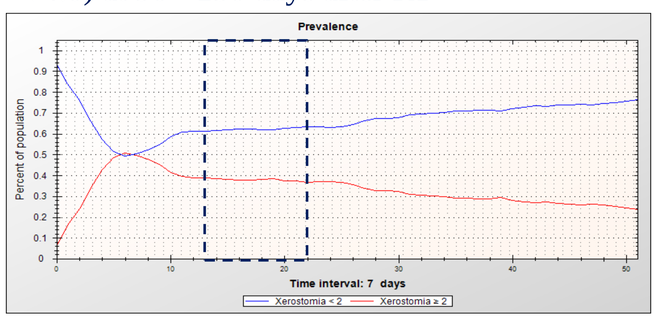
- To develop a comprehensive prediction model for the development of radiation-induced xerostomia, forecast the risk of xerostomia among different patients
- To enhance treatment decisions and provide a foundation for a personalized xerostomia learning health system

Materials/Methods

Data collection and study design



- Study design: Case-control study
- Primary outcome: xerostomia grade (CTCAE v4.0) at 90 - 150 days after RT



- Risk factors: demographic factors, clinical assessments, medical history, volumetric factors, dosimetric factors
- Statistical analysis: Logistic regression; Classification and Regression Tree (CART)

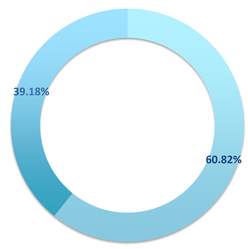
Results

Table 1. Baseline Characteristics

❖ **Baseline imbalanced characteristics**

Severe xerostomia group

- N = 125
- Chemotherapy: 61.34%
- HPV: 55.89%
- Weight loss: 9.23 ± 7.42
- Parotid D95: 6.6 ± 5.03
- Submandibular D70: 41.94 ± 23.59 Gy



Reference group

- N = 194 (60.82%)
- Chemotherapy: 80%
- HPV: 78.57%
- Weight loss: 5.36 ± 5.87
- Parotid D95: 10.88 ± 6.33
- Submandibular D70: 55.72 ± 12.80 Gy

❖ **Baseline balanced characteristics**

- Age: 57.82 ± 11.10 (yo)
- Male: 76.8%
- Caucasian: 75.69%
- Smoking: 49.47%
- Alcohol use: 50.68%
- Tumor site:
  - Oral cavity: 1.28%
  - Nasopharynx: 4.49%
  - Hypopharyx: 1.6%
  - Larynx: 14.42%
  - Others: 54.49%
- Primary tumor stage:
  - 0: 4.58%
  - 1: 22.08%
  - 2: 32.92%
  - 3: 18.33%
  - 4: 22.08
- Regional lymph nodes stage:
  - 0: 24.79%
  - 1: 15.55%
  - 2: 56.72%
  - 3: 2.94%
- Distant metastasis: 0.91%
- Taste change: 37.57 ± 32.36
- KPS:
  - < 80: 11.39%
  - ≧ 80: 88.61%
- Combined parotid volume: 58.13 ± 20.72 (cc)
- Combined submandibular volume: 17.81 ± 11.84 (cc)

Figure 1. Non-parametric Modeling - CART

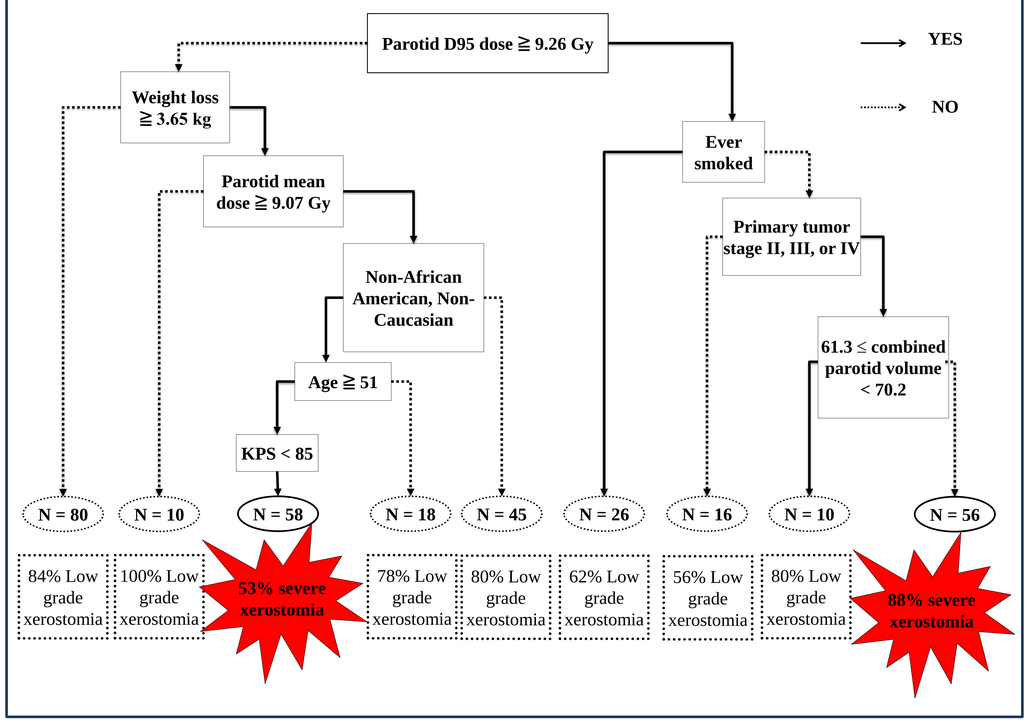
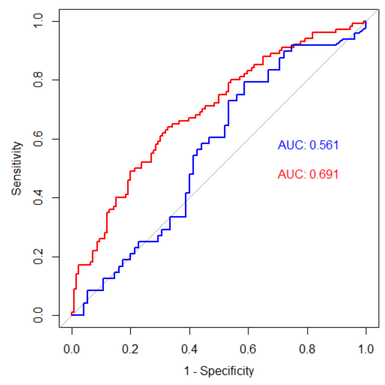


Table 2. Backward Stepwise Elimination

	OR	p-value	95% Confidence Interval
alpha = **0.05**			
Parotid D95	1.15	<0.001	[1.09, 1.21]
Submandibular D70	1.04	<0.001	[1.01, 1.05]
Submandibular D60	1.05	0.036	[1.02, 1.07]
alpha = **0.01**			
Parotid D95	1.15	<0.001	[1.09, 1.21]
Submandibular D70	1.04	<0.001	[1.01, 1.05]

Figure 2. ROC curves of prediction using parotid D95 and parotid mean dose



- CART with10-fold cross-validation to compare prediction power using parotid D95 and parotid mean dose
- AUC(parotid D95) = 0.691
- AUC(parotid mean dose) = 0.561

	AUC	Accuracy*	Sensitivity	Specificity
Parotid D95	0.691	0.659	0.640	0.674
Parotid mean dose	0.561	0.561	0.792	0.413

*Accuracy: the weighted average of a test's sensitivity and specificity

Table 3. Parametric Modeling – Univariate Analyses

Parameters	OR	p-value	95% Confidence Interval
Chemotherapy			
No	ref.		
Yes	2.52	**0.001**	[1.49, 4.26]
HPV			
No	ref.		
Yes	2.67	**<0.001**	[1.32, 5.38]
Weight loss at 1st visit			
≤ 5 kg	ref.		
loss > 5 kg	2.58	**<0.001**	[1.62, 4.09]
Parotid D95			
	1.15	**<0.001**	[1.09, 1.21]
Submandibular D70			
	1.04	**<0.001**	[1.02, 1.06]
Parotid mean dose			
	1.04	**0.023**	[1.01, 1.08]

Conclusions

- The **low dose bath (at 9.26 Gy) -** a potentially important treatment-modifying parameter to reduce the risk of severe xerostomia.
- **A better accuracy** for parotid D95 than the conventional parotid mean dose.
- A risk prediction model to be incorporated into **learning health system**.