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CT-Based Integrated Body Phenotyping Captures Host Susceptibility to Radiation Pneumonitis in Locally Advanced NSCLC

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Disclosures

- No disclosures

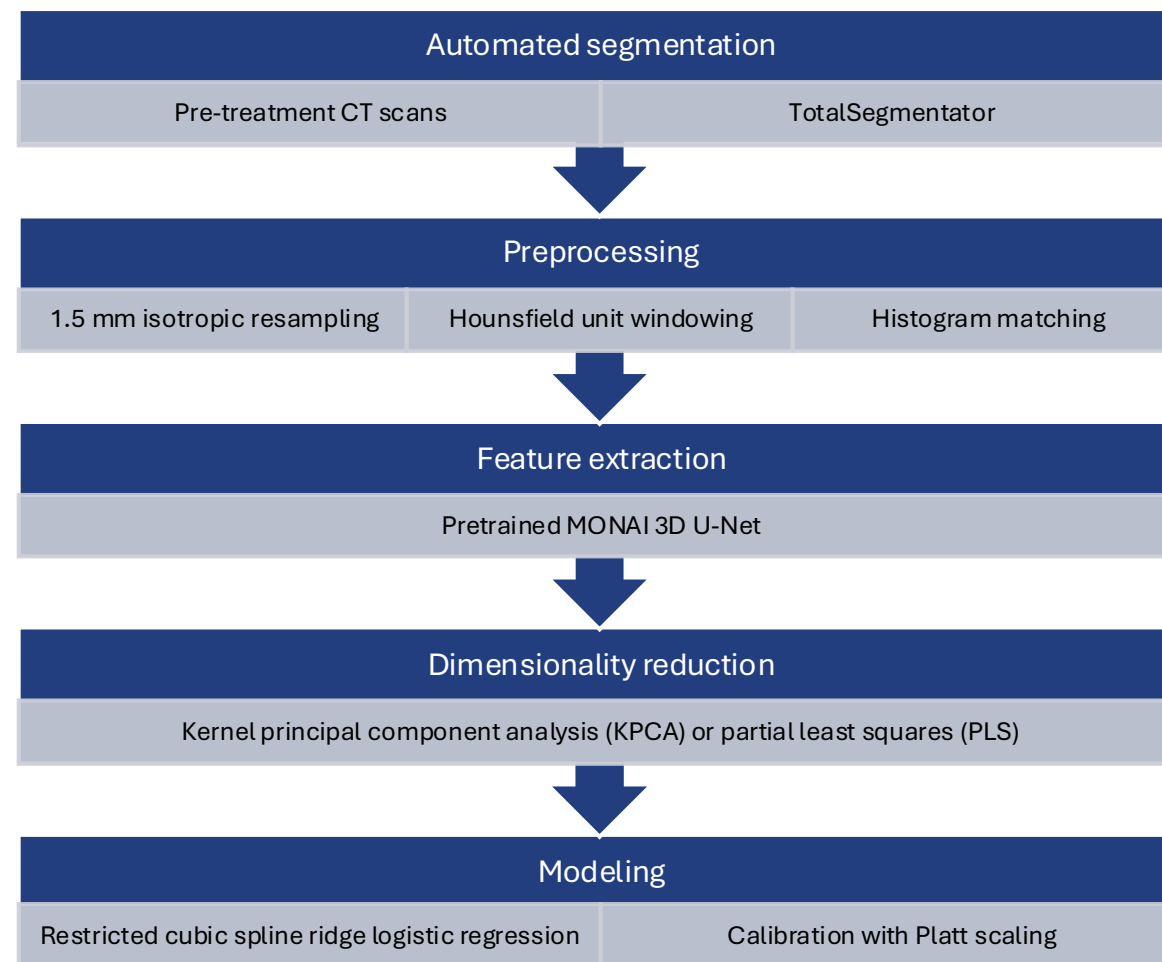
Introduction

- **Radiation pneumonitis (RP)** is a dose-limiting toxicity that drives worse outcomes in patients with **locally advanced non-small cell lung cancer (LA-NSCLC)** receiving chemoradiotherapy (CRT)
 - Imaging-derived tissue characteristics reflect systemic inflammatory and metabolic status yet remain underexplored as predictors of treatment-emergent adverse events, including RP
 - Existing models for RP prediction predominantly rely on lung dosimetry and clinical factors
- **Hypothesis:** Can **CT-derived volumetric composite tissue characteristics** capture latent spatial heterogeneity reflecting host susceptibility to toxicity?

Methods

- Cohorts:
 - **RTOG:** Patients receiving CRT on the RTOG 0617 trial (n=453)
 - **MSKCC:** Patients receiving CRT followed by durvalumab per the PACIFIC regimen at MSKCC (n=224)
- Data: CT-based deep learning features from tissue compartments
 - **Body fat:** subcutaneous fat + torso fat
 - **Body composition:** body fat + intermuscular fat + skeletal muscle
 - **All tissues:** body composition + spleen, liver, pancreas
- Modeling:
 - Primary endpoint: grade 3+ RP
 - Performance: out-of-fold area under the curve (AUC) with 95% confidence interval (CI) from bootstrap resampling (n=400), average precision (AP), and Brier score

CT-based integrated body phenotyping pipeline:



Results

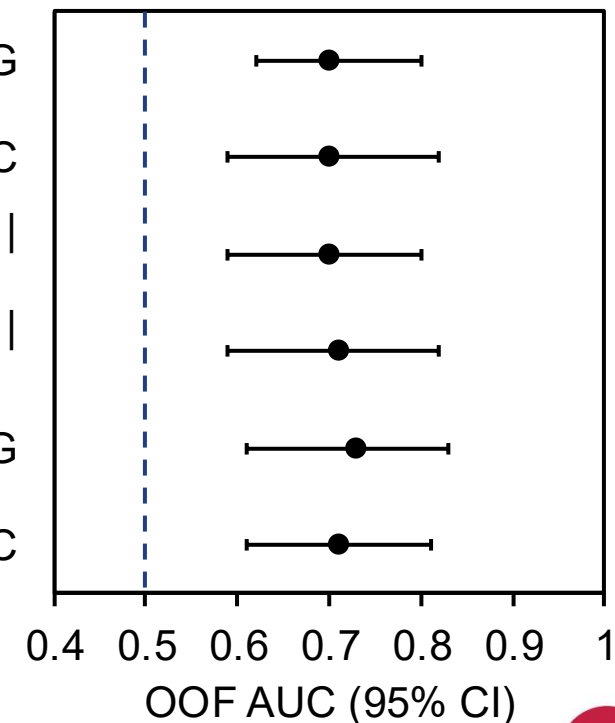
- Grade 3+ RP event rates:
- Model performance:

RTOG: 5.5% grade
3+ RP

MSKCC: 9.4% grade
3+ RP

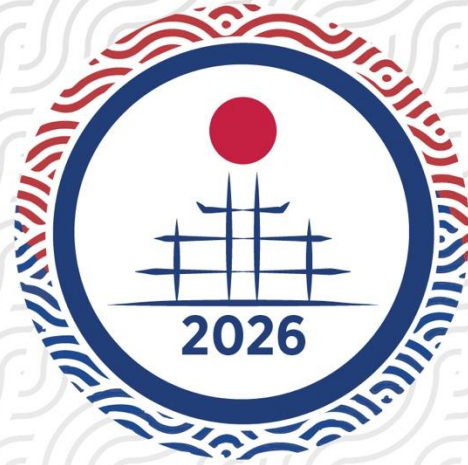
Model	Cohort	OOA AUC	AP	Brier Score
KPCA Body fat	RTOG	0.70	0.15	0.05
KPCA Body fat	MSKCC	0.70	0.17	0.08
PLS-1 Body composition	RTOG	0.70	0.19	0.05
PLS-1 Body composition	MSKCC	0.71	0.18	0.08
PLS-1 All tissues	RTOG	0.73	0.19	0.05
PLS-1 All tissues	MSKCC	0.71	0.17	0.08

KPCA | Body fat | RTOG
KPCA | Body fat | MSKCC
PLS-1 | Body composition |
RTOG
PLS-1 | Body composition |
MSKCC
PLS-1 | All tissues | RTOG
PLS-1 | All tissues | MSKCC



Conclusions

- **CT-derived tissue features predicted high-grade radiation pneumonitis in patients with LA-NSCLC treated with CRT +/- immunotherapy**
 - Features were extracted via a high-throughput, automated deep-learning pipeline from routine pre-treatment CT
 - Multi-organ imaging can be a noninvasive sensor of systemic host biology and quantify individual susceptibility to treatment-related toxicity
- **Future directions**
 - Integration with existing risk stratification frameworks that use lung dosimetry and clinical factors can help identify patients who may benefit from individualized dose optimization, more frequent monitoring, and prophylactic or alternative treatment strategies



Thank You.●