

# Radiomic Clustering of First-Order Features Predicts Postoperative Outcomes Following Pituitary Adenoma Resection

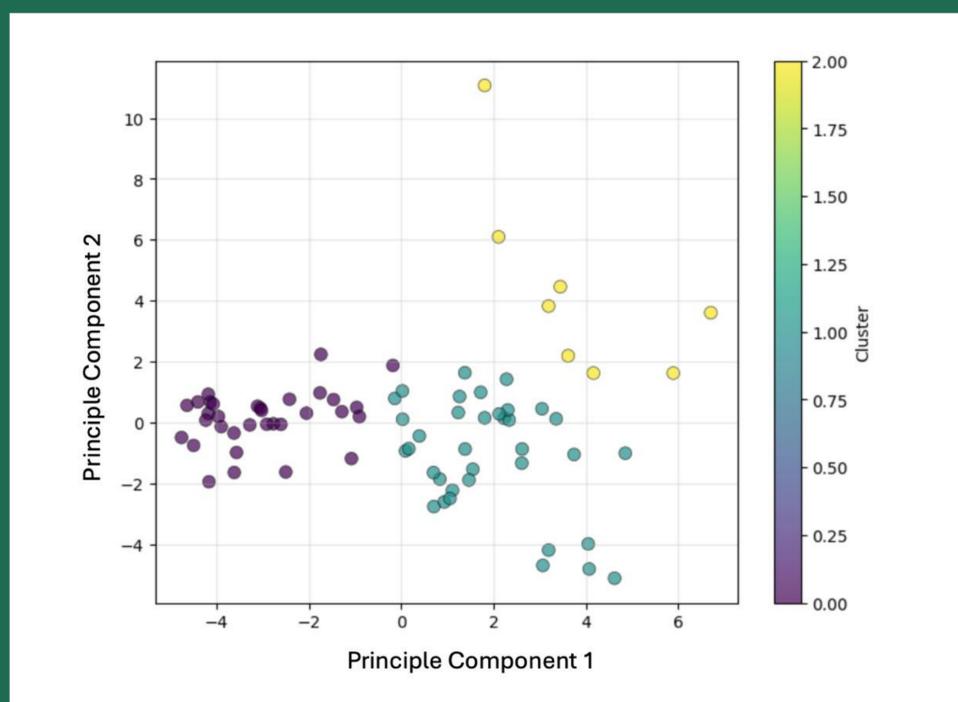
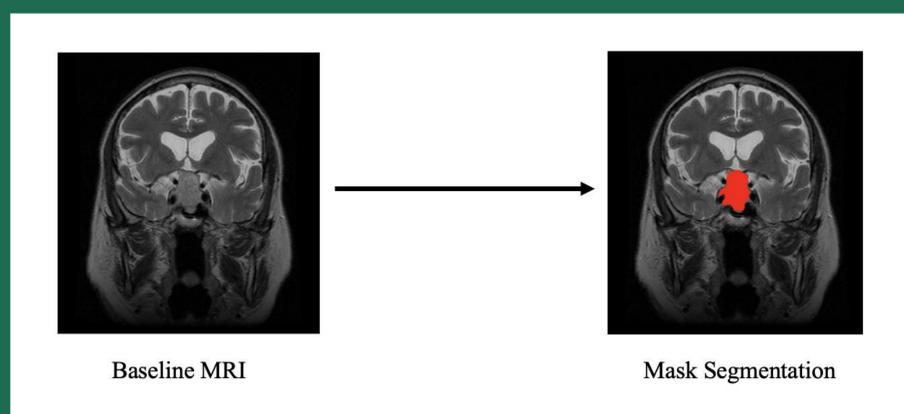
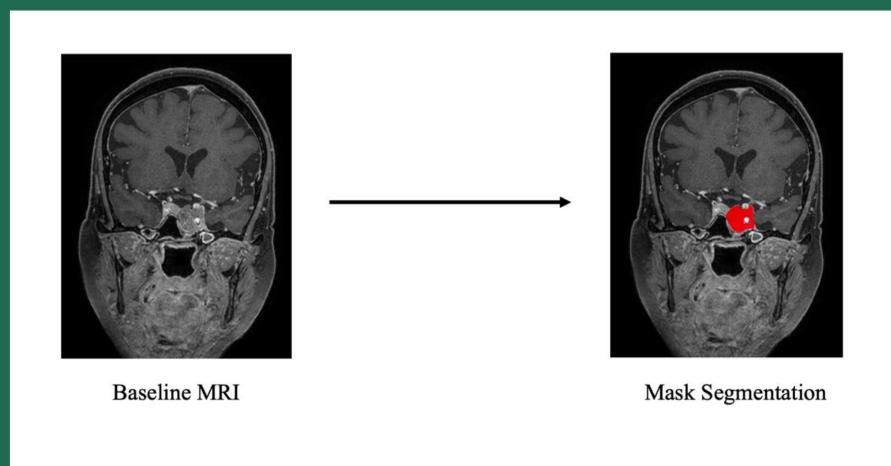
Mohammad Hamo, BS; Dhanush Amin, MD; Yifei Sun, BS; Alexander Mullen, MD; Hariteja Ramapuram, BS; Michael E. Ivan, MD; Carolina G. Benjamin, MD; Kristen Riley, MD; Elizabeth Liptrap, MD; Dagoberto Estevez-Ordonez, MD, PhD

## Background

- Transsphenoidal resection of pituitary adenomas can result in postoperative complications.
- Imaging assessments do not fully capture tumor heterogeneity.
- Radiomic analysis offers quantitative assessment of tumor intensity and patterns.
- **The objective was to determine whether clustering of first-order radiomic features can identify subgroups associated with postoperative complications.**

## Methods

- Single-center retrospective cohort of 77 patients (2012–2024) undergoing transsphenoidal pituitary adenoma resection.
- Image acquisition and preprocessing
  - Preoperative T1- and T2-weighted MRI
- Segmentations by neuroradiologist
- Radiomic analysis using PyRadiomics (v.3.0.1, Python 3.11.4)
- K-means clustering
  - Downstream chi-square and Fisher's exact testing
- Outcomes evaluated: Diabetes insipidus, hypopituitarism, hyponatremia, readmissions



**Image intensity quantitatively described: First-Order radiomic features**

Describes the distribution of voxel intensities within the image region defined by the mask through commonly used descriptive statistics and basic metrics. Examples include total energy, minimum, maximum, mean, median, and standard deviation.

## Results

- Clustering identified three distinct tumor phenotypes:
  - **Cluster 1 (n = 33):** Low-intensity tumors
  - **Cluster 2 (n = 36):** Heterogeneous/intermediate intensity tumors
  - **Cluster 3 (n = 8):** Hyperintense tumors
- Postoperative outcomes
  - Diabetes insipidus incidence differed significantly between clusters (p=0.002)
    - Cluster 3 experienced higher rates of DI compared to:
      - Cluster 1 (p=0.007)
      - Cluster 2 (p=0.001)
  - No significant differences seen in other outcomes:
    - Hypopituitarism (p = 0.409)
    - Hyponatremia (p = 0.943)
    - 30-day readmission (p = 0.483)
    - 60-day readmission (p = 0.509)
    - 90-day readmission (p = 0.130)

## Conclusions and Clinical Implications

- First-order radiomic clustering could identify biologically meaningful tumor subgroups.
- Hyperintense radiomic phenotypes may be associated with increased risk of postoperative diabetes insipidus.
- Radiomic phenotyping may improve preoperative risk stratification.

## Future Directions

- External validation with multi-center cohorts.
- Exploration with multi-parametric radiomic features.
- Develop predictive models incorporating radiomic cluster assignments.