ATS 2024 Highlights

Respiratory Structure and Function Early Career Professionals

Get to know members of the RSF Assembly

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Is your research clinical, basic science or translational?

Translational.

Tell us about your research?

My research focuses on utilizing advanced quantitative lung imaging to investigate the role of abnormal airway morphology in asthma. Despite high-dose inhaled treatment, a subset of patients with asthma continue to experience uncontrolled symptoms. We postulate that the variable response to first-line inhaled therapies in asthma may be due to patient-specific airway morphology influencing inhaled drug delivery and efficacy. My current focus is to determine if imaging-derived measures of airway morphology and function are predictors of biological, physiological and clinical response to first-line inhaled therapies in asthma.

Where do you see yourself in 5 years?

In five years, I will continue pursuing my passion for research, further unveiling new innovative pulmonary imaging techniques to facilitate asthma diagnosis, drug development, and advocating for personalized medicine. I hope to maximize efforts from academic research centers to enhance patient care and management.

What do you find is the major benefit of RSF Assembly Membership?

As an early career professional, I am grateful for the RSF Assembly in facilitating my experience at the 2024 ATS International Conference. The RSF Assembly was an exciting venue that encouraged networking with researchers and trainees of similar interests. I had the opportunity to showcase my first 1st-author abstract, enabled by the RSF Abstract Scholarship and ECP Highlights.

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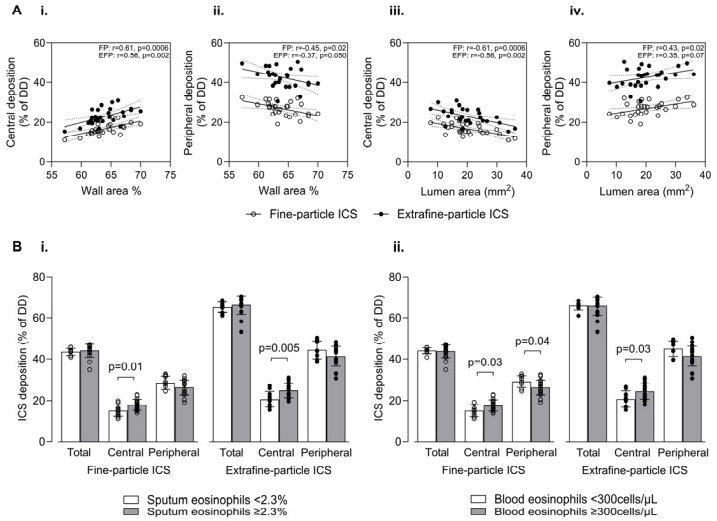

Relationship between airway morphology, eosinophilic inflammation, and simulated ICS deposition (as a percentage of delivered dose (% of DD)) in patients with severe asthma.

Characterizing Inhaled Corticosteroid Deposition In Patients With Severe Asthma Based On Eosinophilic Inflammation And Airway Morphology

Objective: Using Functional Respiratory Imaging (FRI)[1,2] to simulate patient-specific ICS deposition, our objectives were to characterize ICS deposition in patients with severe asthma, ascertain the relationship between deposition and airway morphology, and compare deposition between patients with and without elevated eosinophils.

Methods: Twenty-eight patients with severe asthma performed full-inspiration and full-expiration chest computed tomography (CT) on the same-day that sputum eosinophil percent and blood eosinophil count were measured. CT-derived patient-specific airway models and internal airflow distribution were coupled to simulated inhalers to quantify total, central, and peripheral airway deposition of fine-particle ICS (ICS_{FP}) (fluticasone-propionate HFA) and extrafine-particle ICS (ICS_{EFP})(beclomethasone-dipropionate HFA) using FRI[1,2] (FLUIDDA Inc.) and computational fluid dynamics. CT wall area percent (WA%) and lumen area (LA) were quantified using VIDA|vision (VIDA Diagnostics Inc.). Within and between-group differences were evaluated using paired and unpaired t-tests, respectively. Univariate relationships were evaluated using Pearson correlations.

Results: All participants (13F:15M; mean age=53±13years) were receiving high-dose ICS and 71% had uncontrolled asthma. The mean total (66±4% vs. 44±3%,p<0.0001), central (23±4% vs. 17±3%, p<0.0001), and peripheral (43±5% vs. 27±4%, p<0.0001) airway deposition was greater for ICS_{EFP} than ICS_{FP}. Figure 1A shows that higher WA% and lower LA were correlated with higher central and lower peripheral deposition of ICS_{FP} (WA%: central, r=0.61, p=0.0006; peripheral, r=-0.45,p=0.02; LA: central, r=-0.61, p=0.0006; peripheral, r=0.43, p=0.02). Similar correlations were observed for ICS_{EFP}, although the relationships were attenuated. Participants with elevated sputum eosinophils (i.e., ≥2.3%) (Figure 1Bi) had higher central and a trend towards lower peripheral deposition of ICS_{FP} (central, p=0.01; peripheral, p=0.10) and ICS_{EFP} (central, p=0.005; peripheral, p=0.10). Participants with elevated blood eosinophils (i.e., ≥300cells/µL) (Figure 1Bii) had higher central and lower peripheral deposition of ICS_{FP} (central, p=0.03; peripheral, p=0.04) and ICS_{EFP} (central, p=0.03; peripheral, p=0.06).

Conclusion: In severe asthma patients with thicker airway walls, narrower airway lumens, and elevated eosinophils, we observed higher central and lower peripheral airway deposition of fine-particle ICS. Extrafine-particle ICS did not fully mitigate this. Our observations suggest that patient-specific airway morphology may impact ICS deposition and contribute to sub-optimal treatment response.

[1]De Backer *et al.* Radiology (2010), [2]Sadafi *et al.* Scientific Reports (2024)

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