Validation of Ventilation and Perfusion Using Non-Contrast Computerized Tomography

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Introduction Ventilation (V) and perfusion (Q) remain the main physiologic correlates to assess respiratory gas exchange. Currently several modalities can be used to ascertain V/Q with inhaled/injected radiotracers. Novel approaches to assessing V/Q using non-contrasted imaging methods have been developed, yet there is little work validating these in adults with and without respiratory disease. We aimed to validate V/Q generated from non-contrast CT to Single-Photon Emission Computed Tomography (SPECT). Methods Participants were recruited as part of a larger registry including controls and individuals with COPD. Sociodemographic data, anthropometric measurements and spirometry was conducted according to ATS/ERS criteria. Participants underwent high resolution inspiratory/expiratory CT scans. SPECT was performed with Tc-99m macro aggregated albumin (MAA). V/Q was calculated for both CT and SPECT-generated studies. Scatter plots were created and Pearson correlation coefficients were calculated. Results 25 healthy controls and 20 participants with COPD were enrolled. The average age was 50.8 years, average BMI was 26.3 kg/m2, and 44.4% of the participants were female. The mean FEV1 was 45.3% predicted in the COPD group and 89.6% in the control group. The mean SGRQ score was 39.9. There was strong correlation between V/Q generated by CT compared to SPECT ($r = 0.91$ and 0.80, $p < 0.001$). The correlation between V/Q among individuals with COPD was lower ($r = 0.66$ and 0.69, $p < 0.001$). Discussion V/Q can be ascertained by non-contrast CT studies. Though there is variation among individuals with airway disease, the potential to use non-contrasted inspiratory and expiratory CT scans expands the potential for application across a range of respiratory conditions.

Awards Won:
Third Award of $1,000
Air Force Research Laboratory on behalf of the United States Air Force: Glass trophy and USAF medal for each recipient
Air Force Research Laboratory on behalf of the United States Air Force: First Award of $750 in each Regeneron ISEF Category,