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Title: Comparing airway morphometry and lung density in asthma, COPD and healthy controls using quantitative CT (QCT)

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Body: Background: Asthma and COPD have a number of similarities and differences. Aim: We sought to determine the extent to which moderate to severe asthma and COPD represent distinct or overlapping conditions in terms of large and small airway disease and emphysema determined by QCT. Methods and materials: 213 Patients, (98 asthma, 42% male; 68 COPD, 65% male; 47 healthy 57% male; age (SEM) years, 54 (1), 68 (1), 57 (2) respectively), underwent low dose CT scan. Post processing was done using fully automated software, Apollo (Vida Diagnostics, Iowa). Apical segment right upper lobe percentage wall area (RB1 %WA), percentile 15 (Perc15) and lung density expiration/inspiration (MLD E/I) were used to assess large airway morphometry, emphysema and small airway disease due to 'air trapping' respectively. Results: The median (IQR) RB1 %WA was significantly increased in subjects with COPD (63.5 [61.8-65.24]) and asthma (63.42 [62.63-66]) compared to healthy controls (60.79 [58.48-63]) ($p<0.005$). There was no statistical difference between asthma and COPD. MLD E/I was significantly different with between groups and was most marked in those subjects with COPD (0.929 [0.909–0.953]) versus those with asthma (0.865 [0.821-0.915]) and healthy controls (0.826 [0.758-0.863]) ($p<0.005$). Perc15 was statistically increased in COPD subjects median (-966HU [-976 to -956]) compared to those with asthma (-944HU [-953 to -930]) and healthy controls (-940HU [-953 to -933]) ($p<0.005$). Conclusion: The contributions of large and small airway and emphysema in asthma and COPD can be quantified. Emphysema is not a feature of moderate to severe asthma.