**Grey matter atrophy, retinal vessel dilatation & reduction in aortic distensibility in COPD: The relationship between multi-organ vascular measures.**

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Background

COPD is linked to risk of MI, stroke and white matter brain lesions, but there is no recognised method of identifying those who go on to have acute vascular events. It also remains unclear if vascular risk in COPD is truly independent of smoking. The Novel Vascular Manifestations of COPD (NoVasC) study was designed to address this limitation through direct comparison of COPD patients and smoking controls using multimodal brain MRI, retinal photography, cardiac MRI (CMR) and aortic stiffness in addition to cognitive and disease severity measures.

Methods

MR brain volumes, diffusion, blood flow and white matter lesions were acquired for 27 COPD patients (age 67±8, 41% male, pack years 39±21, FEV1 58±18% predicted) and 23 controls (age 63±9, 48% male, pack years 30±14, FEV1 101±19% predicted). CMR of LV and RV function, volumes and aortic distensibility were captured using a 3-Telsa MR scanner. Pulse wave velocity and augmentation index were acquired using Vicorder. Retinal fundus photographs were analysed using validated automated software (SIVA). Analyses adjusted for differences in age, gender, blood pressure and pack years smoked.

Results

Significant differences in grey matter volume (p=0.004), retinal vessels (p=0.005) and CMR (p=0.01) were identified in COPD (Table 1). There was significant correlation between grey matter volume and BMI (r=-0.42 p=0.005) only. White matter lesion volume was associated with FEV1/FVC and creatinine (r=0.29 p=0.048 and r=-0.33 p=0.027). Cerebral blood flow was associated with arterial pH in COPD (r=-0.49 p=0.019).There were no significant associations identified between other MR brain, cognition, disease severity or retinal measures. Significant correlations were identified between CMR and white matter damage (DTI r=0.50 p=0.001) and FEV1/FVC (r=0.447 p=0.003) and retinal measures with FEV1 % pred (r=-0.43 p=0.006).

Conclusions

Grey matter atrophy, retinal vessel dilatation, and aortic distensibility are present in COPD. White matter lesions volume is associated with lung function but there was no relationship between other MRI brain measures, cognition or disease severity. Non-invasive vascular measures of retinal vessels and cardiac MR appear to relate to lung function and white matter damage and warrant further investigation in larger longitudinal studies of vascular events in COPD.

Table 1 COPD group vs. smoker controls ANOVA corrected for age, gender, mean arterial blood pressure and pack years smoked

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|   | Sum of Squares | df | Mean Square | F | Sig. |
| Normalised White Matter VolumeVoxel based Morphometry. (VBM) | Between Groups | 0.625 | 1 | 0.625 | 0.115 | 0.736 |
| Within Groups | 260.862 | 48 | 5.435 |   |   |
| Total | 261.487 | 49 |   |   |   |
| Normalised Grey Matter Volume. VBM | Between Groups | 19.169 | 1 | 19.169 | 9.181 | **0.004†** |
| Within Groups | 100.216 | 48 | 2.088 |   |   |
| Total | 119.385 | 49 |   |   |   |
| Retina Factor | Between Groups | 7.589 | 1 | 7.589 | 8.925 | **0.005†** |
| Within Groups | 37.411 | 44 | 0.850 |   |   |
| Total | 45.000 | 45 |   |   |   |
| Cardiac MR Factor | Between Groups | 6.204 | 1 | 6.204 | 7.015 | **0.011†** |
| Within Groups | 39.796 | 45 | 0.884 |   |   |
| Total | 46.000 | 46 |   |   |   |
| Cerebral Diffusion Tensor  | Between Groups | 2.283 | 1 | 2.283 | 2.345 | 0.132 |
| Within Groups | 46.717 | 48 | 0.973 |   |   |
| Total | 49.000 | 49 |   |   |   |
| Cerebral Blood Flow | Between Groups | 0.454 | 1 | 0.454 | 0.449 | 0.506 |
| Within Groups | 48.546 | 48 | 1.011 |   |   |
| Total | 49.000 | 49 |   |   |   |
| White Matter Lesions | Between Groups | 0.412 | 1 | 0.412 | 0.407 | 0.526 |
| Within Groups | 48.588 | 48 | 1.012 |   |   |
| Total | 49.000 | 49 |   |   |   |

**†**p value < 0.01