Cardiovascular aspects on chronic obstructive pulmonary disease
-with focus on ischemic ECG abnormalities, QT prolongation and arterial stiffness

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Aim: To describe cardiovascular aspects on COPD, with a specific focus on arterial stiffness and ischemic ECG abnormalities, QT prolongation and arterial stiffness.

Methods: All subjects with airway obstruction (n=993) and age- and sex matched referents were identified after re-examination of population-based cohorts in 2002-04. They have been invited to annual examinations since 2005 including spirometry and interview. Papers I-III are based on data from 2005 including ECG, paper IV is based data from 2010 including arterial stiffness (pulse wave velocity, PWV). ECGs were Minnesota coded and QT-interval was measured and corrected for heart rate (QTc). Spirometric classification: normal lung function (NLF), restrictive spirometric pattern (RSP) and airway obstruction (COPD); post-bronchodilator FEV1/VC<0.70 (GOLD) (papers I-IV,) and lower limit of normal (LLN) (paper III). Disease severity was based on FEV1 % pred; as a continuous variable or divided into GOLD grade 1-4. Mortality data was collected until 31st December 2010 (paper II and III).

Results: The prevalence of self-reported ischemic heart disease (IHD) and ischemic ECG abnormalities (I-ECG), was similar in NLF and COPD, but increased by GOLD grade (paper I). The cumulative mortality was higher among those with (+) than without (-) I-ECG, in COPD 29.6 vs. 10.6%, p<0.001 and, in NLF 17.1 vs. 6.3%, p=0.001. COPD+I-ECG and NLF+I-ECG had an increased risk for death compared with NLF-I-ECG; Mortality Risk Ratio (MRR, 95%CI) (2.4, 1.5-3.9 and 1.65, 0.94-2.90). COPD+I-ECG had an increased risk for death independent of confounders and FEV1 % predicted (1.89, 1.20-2.99). The proportion without reported IHD was high among those with I-ECG; 72.4% in NLF and 67.3% in COPD. Also among them I-ECG was associated with an increased risk for death (paper II). The prevalence of QTc prolongation was higher in RSP than NLF but similar in NLF and GOLD-COPD, and increased by GOLD grade (test for trend p=0.012). In GOLD-COPD, 52% fulfilled the LLN-criterion (LLN-COPD). The pattern was similar when comparing LLN-COPD and NLF as NLF and GOLD-COPD. The cumulative 5-year mortality was higher among subjects with prolonged QTc than normal QTc in subjects with GOLD-COPD and LLN-COPD but not in NLF and RSP (paper III). PWV was higher in GOLD 3-4 than non-COPD (10.52 vs. 9.13 m/s, p=0.042), and GOLD 3-4 remained associated with higher PWV when compared with non-COPD, also when adjusted for confounders (paper IV).

Conclusion: In this population-based study, the prevalence of I-ECG was similar in NLF and COPD, but increased by COPD severity. I-ECG was associated with an increased mortality also among those without known heart disease. The prevalence of QTc prolongation was similar in NLF, GOLD-COPD and LLN-COPD, but increased with COPD severity and was associated with an increased crude mortality only in COPD. ECG is a simple non-invasive method and seems to identify findings of prognostic importance among subjects with COPD. Central arterial stiffness, a known risk factor for cardiovascular disease, was increased among subjects with GOLD grade 3-4.

Keywords
Epidemiology, COPD, ischemic heart disease, cardiovascular disease, ECG, spirometry