

Smoking is the Strongest Modifiable Risk Factor for Mortality Post Coronary Revascularisation

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The prevalence of coronary artery bypass grafting (CABG) or percutaneous coronary intervention (PCI) is increasing in the general population due to improved prognosis and access to procedures.^{1,2} However, the risk of cardiovascular events and death remains high post coronary revascularization despite the availability of novel medical therapies.^{3,4,5} In the current study, we aimed to determine the predictive value of the conventional cardiac risk factors of invasively treated coronary artery disease (CAD) patients in the random sample of Finnish individuals drawn from the general population.

The FINRISK studies are carried out every 5 years by the Finnish National Institute for Health and Welfare. The studies are based on stratified random samples of the population aged 25–74 years from specific geographical areas of Finland. Of the 23 803 participants examined in FINRISK 2002, 2007, and 2012 studies, we identified 383 individuals who had undergone PCI or CABG, and had complete data available for CAD risk factors (age, sex, body mass index [BMI], smoking, diabetes, low-density lipoprotein cholesterol [LDL-C], high-density lipoprotein cholesterol [HDL-C], systolic blood pressure [SBP] and leisure-time physical activity). The main outcome was all-cause mortality registered in the nationwide Causes of Death register before December 31, 2014.

Baseline characteristics between cohorts were compared using analysis of variance. We used Cox proportional hazards models and population attributable fractions to determine the relationship between CAD risk factors and death. All risk factors and cohort were simultaneously included in the model as covariates. P-value <0.05 was considered statistically significant.

The mean age of invasively treated CAD patients increased from 62.7 years in 2002 to 66.3 years in 2012 ($p < 0.001$; Table). The mean LDL-C decreased during the same study period from 2.8 (0.8) to 2.2 (0.8) mmol/l ($p < 0.001$). The proportion of patients with diabetes increased from 15.0% to 28.7% from 2002 to 2012 ($p = 0.03$). Other risk factors did not significantly change from 2002 to 2012. (Table)

64 (16.7%) individuals died over a median follow-up of 7.0 years. Expectedly, age was positively associated with increased the risk of death after PCI or CABG (HR 1.09 per 1-SD increase, 95% CI 1.04-1.13, $p < 0.001$). Diabetes, LDL-C, HDL-C, gender, BMI, physical activity or SBP were not related to mortality. However, a continuation of smoking after coronary revascularization increased the risk of death markedly (HR 2.60, CI 1.37-4.91, $p = 0.003$, Table). The population attributable

fraction (the proportion of mortality in the population that are attributable to the risk factor) for smoking was 14.8% (95%-CI 1.4-28.2%, p=0.03).

In accordance with current medical standards, all CAD patients are nowadays treated increasingly aggressively with lipid lowering medications, aspirin, and antihypertensive therapies (including beta blockers) as recommended in the guidelines.^{3,4} In addition, the treatment targets for blood pressure and LDL-C are continuously being lowered. As a result, many of the conventional, but relatively well-treated risk factors were not associated with mortality in invasively treated CAD patients in the general population. Surprisingly, smoking was the strongest and only modifiable risk factor that associated with post-CABG mortality, accounting for 14.8% of mortality risk.

Smoking is a well-known risk factor of CAD.^{6,7} However, it seems its importance is becoming more apparent when the effects of other risk factors are being minimized by aggressive therapies. The proportion of smokers remained similar during the study period implying that tobacco education is not effective in certain patients who have undergone coronary revascularization. In addition to pharmaceutical therapies, doctors need to pay attention to patients' permanent lifestyle changes, and to smoking cessation in particular after coronary revascularisation.

Declaration of conflicting interests

The authors report no conflicts of interest.

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References:

1. Kiviniemi TO, Pietilä A, Gunn JM, et al. Trends in rates, patient selection and prognosis of coronary revascularisations in Finland between 1994 and 2013: the CVDR. *EuroIntervention* 2016; 12: 1117-1125.
2. Fokkema ML, James SK, Albertsson P, et al. Population trends in percutaneous coronary intervention: 20-year results from the SCAAR (Swedish Coronary Angiography and Angioplasty Registry). *J Am Coll Cardiol* 2013; 61: 1222-30.
3. Hillis LD, Smith PK, Anderson JL, et al. 2011 ACCF/AHA Guideline for Coronary Artery Bypass Graft Surgery: a report of the American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines. *Circulation* 2011; 124: e652-735.
4. Levine GN, Bates ER, Blankenship JC, et al. 2015 ACC/AHA/SCAI Focused Update on Primary Percutaneous Coronary Intervention for Patients With ST-Elevation Myocardial Infarction: An Update of the 2011 ACCF/AHA/SCAI Guideline for Percutaneous Coronary Intervention and the 2013 ACCF/AHA Guideline for the Management of ST-Elevation Myocardial Infarction. *J Am Coll Cardiol* 2016; 67: 1235-1250.
5. Pardaens S, Willems AM, Clays E, et al. The impact of drop-out in cardiac rehabilitation on outcome among coronary artery disease patients. *Eur J Prev Cardiol* 2017; 24: 1490-1497.
6. Trașcă SP, Goanță EV, Târtea GC, et al. The Impact of the Risk Factors in the Evolution of the Patients with Left Main Coronary Artery Stenosis Treated with PCI or CABG. *Curr Health Sci J* 2019; 45: 19-27.
7. Ma WQ, Wang Y, Sun XJ, et al. Impact of smoking on all-cause mortality and cardiovascular events in patients after coronary revascularization with a percutaneous coronary intervention or coronary artery bypass graft: a systematic review and meta-analysis. *Coron Artery Dis* 2019; 30: 367-376.