

The risk of admission acute heart failure in ST-elevation myocardial infarction patients and air pollution with PM2.5

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Introduction: Air pollution, in particular exposure to particulate matter fine particles of less than 2.5 microns in diameter (PM2.5), increases the risk of cardiovascular events. Short-term exposure (hours to few days prior) to increased PM2.5 levels even may help trigger ST-elevation myocardial infarction (STEMI) and heart failure exacerbation in susceptible individuals. The risk of vascular events is increased even in exposures below the current European air quality limit values (mean annual levels for PM2.5 less than 10 µg/m³, 24-hour mean level less than 25 µg/m³).

Purpose: To evaluate predictive role of PM2.5 levels ≥ 20 µg/m³ one day prior to hospital admission for the risk of admission acute heart failure (AAHF) in STEMI patients.

Methods: In 290 STEMI patients (100 women, 190 men, mean age 65.5±12.9 years), treated by primary percutaneous coronary intervention (PPCI) in 2018, we retrospectively registered the AAHF, defined as classes II-IV by Killip Kimbal classification. Additionally, we registered admission clinical data, potentially contributing to AAHF in STEMI patients such as gender, age ≥ 65 years, prior resuscitation, admission cTnI ≥ 5 µg/L (normal levels up to 0.045 µg/L), comorbidities, time to PPCI, and mean daily levels of PM2.5 ≥ 20 µg/m³ one day before admission. Mean daily, freely available, levels of PM2.5 were measured and registered by Chemical analytical laboratory of Environmental agency of Republic Slovenia. We evaluated the predictive role of admission data for admission AHF in STEMI patients.

Results: AAHF was observed in 34.5% of STEMI patients with the mean daily PM2.5 level 15.7±10.9 µg/m³ on the day before admission. PPCI was performed in 92.1% of all STEMI patients, in AAHF in 87.1% and in non-AAHF patients in 94.7% (p=0.037). AAHF in comparison to non-AAHF was associated significantly with female gender (50.5% vs 25.9%, p<0.001), age over 65 years (71.3% vs 45%, p<0.001), prior diabetes (33.7% vs 14.8%, p<0.001), left bundle branch block (LBBB) (10.9% vs 0.5%, <0.001), admission cTnI ≥ 5 µg/L (46.7% vs 25.9%, p<0.001) and mean daily levels of PM2.5 ≥ 20 µg/m³ one day before admission (31.7% vs 19%, p=0.020), but nonsignificantly with arterial hypertension, prior myocardial infarction, anterior STEMI and time to PPCI. Logistic regression demonstrated that significant independent predictors of AAHF were age over 65 years (OR 3.349, 95% CI 1.787 to 6.277, p<0.001), prior diabetes (OR 2.934, 95% CI 1.478 to 5.821, p=0.002), admission LBBB (OR 10.526, 95% CI 1.181 to 93.787, p=0.03), prior resuscitation (OR 3.221, 95% CI 1.336 to 7.761, p=0.009), admission cTnI ≥ 5 µg/L (OR 2.984, 95% CI 1.618 to 5.502, p<0.001) and mean daily levels of PM2.5 ≥ 20 µg/m³ (OR 2.096, 95% CI 1.045 to 4.218, p=0.038) one day before admission.

Conclusion: Mean daily levels of PM2.5 ≥ 20 µg/m³ one day before admission were among significant independent predictors of AAHF in STEMI patients.