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Study reports influence of air pollution on pulmonary vascular function

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Air pollution impairs the function of blood vessels in the lungs, according to a study in more than 16 000 patients presented today at EuroEcho-Imaging 2016.

"This is the first human study to report an influence of air pollution on pulmonary vascular function," said lead author Dr Jean-Francois Argacha, a cardiologist at the University Hospital (UZ) Brussels, Belgium. "This is a major public health issue for people living in polluted urban areas where exercise could damage the lungs and potentially lead to decompensated heart failure."

Promoting a safer environment appears to be as important as controlling conventional risk factors, like high cholesterol, in reducing cardiovascular disease. Air pollution consists of particles (particulate matter [PM] of different sizes) and gases (nitrogen dioxide, ozone, etc). The first vascular bed in contact with air pollutants is the pulmonary circulation yet few studies have investigated the impact.

"Such studies are important because if air pollution causes narrowing of the blood vessels in the lungs (vasoconstriction), this combined with the systemic effects of pollution could cause decompensated heart failure," said Dr Argacha.

The current study examined the effect of air pollution on pulmonary haemodynamics in a population and in individuals. The population study assessed whether common levels of outdoor air pollution influence the echocardiography parameters conventionally used to evaluate the pulmonary circulation and right ventricular function. Between 2009 and 2013, transthoracic echocardiography including an evaluation of pulmonary pressure was conducted in 16 295 individuals and correlated with average air pollution in Brussels on the same day and in the last five and ten days. The authors examined whether any patient subgroups were more susceptible to the effects of air pollution.

The individual study examined the effect of air pollution on pulmonary circulation in ten healthy male volunteers exposed to pollutants in a chamber

with standardised conditions. The volunteers were exposed to ambient air or dilute diesel exhaust with a PM_{2.5} concentration of 300 μg/m³ for two hours in a randomised, crossover study design. The effects on pulmonary vascular resistance were assessed with echocardiography at rest and during a cardiac stress test in which the drug dobutamine is given to simulate heart function during exercise.

The population study showed a negative effect of PM₁₀, PM_{2.5} and ozone on pulmonary circulation on the same day and over five and ten days. Specifically, increases in these pollutants were associated with reduced pulmonary acceleration time and increased pulmonary acceleration slope. Increases in PM₁₀ and PM_{2.5} over ten days were associated with worse right ventricle function. The negative impact of PM₁₀ on pulmonary circulation was more pronounced in patients with obstructive sleep apnoea.

Dr Argacha said: "Air pollution was associated with increased pulmonary vascular tone which makes it more difficult for blood to flow to the lungs. Longer exposure to air pollution exposure seems necessary to impair right ventricular systolic function. Patients with obstructive sleep apnoea were at greater risk."

The individual study showed that exposure to diesel exhaust did not modify the pulmonary circulation compared to ambient air when the volunteers were resting but did when dobutamine was administered. "This suggests that pollution is more harmful to the lung circulation during exercise," said Dr Argacha.

He continued: "Our dual approach provides original data on the impact of air pollution on the pulmonary circulation. The individual study strengthens the plausible link emerging from the epidemiological research."

Regarding how to minimise the health risks, Dr Argacha said: "Our main advice is to limit physical activities during heavy air pollution. More studies are needed before specific recommendations on intensity and duration of exercise can be given. Emission controls such as particulate filters have reduced tailpipe emissions, but other sources such as engine crankcases, tyres and brake wear are becoming important. No strong evidence exists on effectiveness of face masks to eliminate or reduce particle exposure."

He added that legislation protecting the population from air pollution is weak. He said: "Diesel emission control has been associated with health outcomes⁵ but unfortunately the standards defined by the European Union differ from those of the World Health Organization."

Source:

European Society of Cardiology
