Air pollution linked to deadly heart rhythm disorder

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Life-threatening arrhythmias are more common on days with highly polluted air, according to research presented May 21 at Heart Failure 2022, a scientific congress of the European Society of Cardiology

(ESC). The study was conducted in patients with an implantable cardioverter defibrillator (ICD), enabling the authors to track the occurrence of arrhythmias and delivery of life-saving therapy.

"Our study suggests that people at high risk of ventricular arrhythmias, such as those with an ICD, should check daily pollution levels," said study author Dr. Alessia Zanni, now working at Maggiore Hospital, Bologna and previously at Piacenza Hospital, Italy. "When particular matter (PM) 2.5 and PM 10 concentrations are high (above 35 $\mu g/m^3$ and 50 $\mu g/m^3$, respectively), it would be sensible to stay indoors as much as possible and wear an N95 mask outside, particularly in areas of heavy traffic. An air purifier can be used at home."

Outdoor air pollution kills an estimated 4.2 million people every year, according to the World Health Organization. Nearly one in five cardiovascular disease deaths are due to dirty air, which was ranked the fourth highest risk factor for mortality after high blood pressure, tobacco use and poor diet.

This study investigated the relationship between air pollution and ventricular arrhythmias in Piacenza, Northern Italy. The European Environment Agency graded the city 307 worst out of 323 cities for annual mean PM2.5 concentrations in 2019 and 2020, with a figure of 20.8 μg/m.

"We had observed that emergency room visits for arrhythmias in patients with ICDs tended to cluster on days with particularly high air pollution," noted Dr. Zanni. "We therefore decided to compare the concentration of air pollutants on days when patients had an arrhythmia versus pollution levels on days without an arrhythmia."

The study included 146 consecutive patients who received an ICD between January 2013 and December 2017. Of those, 93 received an

ICD because of heart failure after a heart attack while 53 had a genetic or inflammatory heart condition. Just over half (79 patients) had never experienced a ventricular arrhythmia, and 67 patients had previously had a ventricular arrhythmia.

Data on ventricular arrhythmias (ventricular tachycardia and ventricular fibrillation) were collected remotely from the ICD until study completion at the end of 2017. The researchers also recorded the therapy delivered by the device. This included antitachycardia pacing for ventricular tachycardia (fast heartbeat), which delivers electrical impulses to the heart muscle to restore a normal heart rate and rhythm. The second therapy was an electric shock to reset the heartbeat during ventricular fibrillation.

Daily levels of PM10, PM2.5, carbon monoxide (CO), nitrogen dioxide (NO_2) and ozone (O_3) were obtained from Regional Environmental Protection Agency (ARPA) monitoring stations. Patients were assigned exposures based on their home address. The researchers analyzed the association between pollutant concentrations and the occurrence of ventricular arrhythmias.

A total of 440 ventricular arrhythmias were recorded during the study period, of which 322 were treated with antitachycardia pacing and 118 were treated with a shock. The researchers found a significant association between PM2.5 levels and ventricular arrhythmias treated with shocks, corresponding to a 1.5% increased risk for each 1 $\mu g/m^3$ rise in PM2.5. They also found that when PM2.5 concentrations were elevated by 1 $\mu g/m^3$ for an entire week, compared to average levels, there was a 2.4% higher likelihood of ventricular arrhythmias regardless of the temperature. When PM10 was 1 $\mu g/m^3$ above average for a week there was a 2.1% raised risk of arrhythmias.

Dr. Zanni said: "Particulate matter may cause acute inflammation of the

heart muscle which could act as a trigger for cardiac arrhythmias. As these toxic particles are emitted from power plants, industries and cars, green projects are needed to protect health, on top of the actions individuals can take to protect themselves."

She concluded: "These data confirm that environmental pollution is not only a climate emergency but also a public health problem. The study suggests that the survival of patients with heart disease is affected not only by pharmacological therapies and advances in cardiology but also by the air that they breathe. This battle can be won by an alliance between scientific societies and politicians to protect not only the environment but also the health of the human population."

More information: Heart Failure 2022

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