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# **Respiratory and Cardiovascular Responses to Diesel Exhaust Exposure**

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# ABSTRACT

**Background:** Exposure to traffic-derived air pollution is associated to high incidence of respiratory and cardio-vascular morbidity and mortality. Diesel engines and fossil fuel contribute to a great amount to the ambient particulate matter pollution. Exposure to diesel exhaust in healthy volunteers is known to cause inflammatory and oxidative responses in the airways. In contrast, very little is known about the air pollution-related mechanisms behind the adverse cardiovascular effects and why patients with cardio-respiratory disease are more susceptible to the adverse effect of particulate matter air pollution.

**Methods:** Volunteers were exposed to diesel exhaust at a particulate matter concentration of 300  $\mu\text{g}/\text{m}^3$  and filtered air for one hour in random order. In studies I-II, patients with moderately severe, stable COPD were examined with lung function, induced sputum and peripheral blood samples. In studies III-V, vascular assessment was performed using venous occlusion plethysmography. Vascular responses to intra-arterially infused endothelial dependent and independent vasodilators were determined, together with endogenous fibrinolysis, systemic inflammation and long-term ECG registration. These vascular studies were carried out in healthy volunteers and patients with stable coronary heart disease.

**Results:** In healthy subjects, diesel exhaust exposure induced an acute vasomotor dysfunction, which was partly sustained at 24 hours. Endogenous fibrinolysis reflected by tissue plasminogen activator (t-Pa) levels and activity were reduced at 6 hours post exposure both in healthy subjects and patients with stable PCI-treated coronary heart disease. During diesel exhaust exposure, ECG analyses demonstrated significant exercise-induced ST-T segment depression in patients with coronary heart disease. These findings occurred at a moderately increased heart rate of approximately 90 beats per minute during both diesel and air exposures.

The investigated group of stable COPD patients did not demonstrate any further deterioration of lung function, induced sputum or systemic inflammatory parameters within the investigated time frame.

**Conclusion:** Inhalation of diesel exhaust impaired two important and complementary aspects of vascular function in healthy subjects; regulation of vascular tone and endogenous fibrinolysis. In men with stable coronary heart disease, exposure to diesel exhaust induced signs of myocardial ischemia, along with impaired endogenous fibrinolytic capacity, despite full secondary preventive medication. These exposure studies support the epidemiological evidence of an association between particulate matter air pollution and adverse cardiovascular effects and demonstrate important underlying mechanisms.