Abstract

Exposure to air pollution increases the risk of cardiovascular morbidity and mortality, especially in susceptible populations with cardiovascular disease. Despite increased risk, adverse responses are often delayed and require additional stress tests to reveal latent effects of exposure. The goal of this study was to use an episode of "transient hypoxia" as an extrinsic stressor to uncover latent susceptibility to environmental pollutants in a rodent model of hypertension. We hypothesized that exposure to acrolein, a potent environmental pollutant and pulmonary irritant, would increase cardiopulmonary sensitivity to hypoxia, particularly in hypertensive rats. Spontaneously hypertensive (SH) and Wistar Kyoto (WKY; normotensive) rats, implanted with biopotential radiotelemetry transmitters, were exposed once for 3 hours to 3 ppm acrolein gas or filtered air in whole body plethysmograph chambers and challenged with a 10% oxygen atmosphere (10 minutes) 24 hours later. Cardiovascular and ventilatory parameters were monitored during acrolein and hypoxia exposures. Acrolein exposure increased heart rate, blood pressure, breathing frequency, and minute volume in the hypertensive rat and also increased the heart rate variability parameter LF, suggesting a potential role for increased sympathetic tone. Normotensive rats only had increased blood pressure during acrolein exposure. The hypoxia stress test after acrolein exposure revealed increased diastolic blood pressure only in the hypertensive rat and increased minute volume and expiratory time only in normotensive rats. These results suggest that hypertension confers exaggerated sensitivity to air pollution and that the hypoxia stress test may be a useful tool to reveal the potential latent effects of air pollution exposure.