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Risk of Air Pollution, Environmental Chemicals, and Climate Changes on Kidney Disease Outcomes

Jeonghwan Lee
SMG-SNU Boramae Medical Center, Korea, Republic of

Environmental factors such as air pollution, chemicals, and temperature are emerging as risk factors for chronic kidney disease (CKD). Recent research suggests that exposure to air pollution is strongly associated with an increased risk of CKD, CKD progression, and end-stage kidney disease (ESKD). Inhaled airborne particles cause vascular injury, intraglomerular hypertension, or glomerulosclerosis via multiple complex interactions between non-hemodynamic and hemodynamic factors. The mechanisms that link exposure to air pollutants to CKD include an increase in blood pressure, a worsening of oxidative stress and inflammatory response, DNA damage, and abnormal metabolic changes that exacerbate kidney injury. It is not only particulate matter that contributes to the poor prognosis of patients with CKD, but also environmental tobacco smoke and gaseous heavy metals. Environmental chemicals have recently been recognized as a major CKD risk factor. Melamine and heavy metals such as lead and cadmium have traditionally been recognized as risk factors for kidney injury and CKD. In addition to being associated with CKD in adults, phthalates and bisphenol A have also been linked to the disease in infants and adolescents. In some populations, perfluoroalkyl acids, dioxins, polycyclic aromatic hydrocarbons, and polychlorinated biphenyls have been suggested as new risk factors for CKD. In an analysis of environment-wide association study, serum and urine cotinines, blood 2,5-dimethylfuran (a volatile organic compound), and blood cadmium were associated with albuminuria. Blood lead and cadmium were associated with reduced eGFR. Blood cadmium and lead and three volatile compounds (blood 2,5-dimethylfuran, blood furan, and urinary phenylglyoxylic acid) were associated with the CKD composite outcome. Several studies have demonstrated the effects of heat exposure on kidney failure (such as acute kidney injury) and urinary dysfunction (such as urinary tract infections) related to kidney failure. During warmer months, a higher incidence of kidney stone disease and renal colic has been reported. According to a meta-analysis of 11 studies, elevated temperatures were associated with a 30% increase in the prevalence of kidney disease.