

Association between Levels of Volatile Organic Compound Metabolites and Cigarette Smoking-Related Urothelial Carcinoma

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Abstract : Cigarette smoke contains volatile organic compounds (VOCs), such as acrylamide, 1,3-butadiene, and benzene. This study aimed to explore the associations between the urinary levels of cotinine and VOC metabolites and the risk of urothelial carcinoma (UC). A hospital-based case-control study involving two groups matched on the basis of age (± 3 years) and gender was designed. UC was clinically diagnosed through urological examinations and pathologically verified. Smoking-related information was collected through questionnaires and face-to-face interviews with all study participants. Urine samples were collected for the analysis of the urinary levels of VOC metabolites, cotinine, and 8-hydroxydeoxyguanosine (8-OHdG), which was selected as a proxy of oxidative stress. Multiple logistic regressions were applied to estimate the risk of UC. The urinary cotinine and 8-OHdG levels of the UC group were higher than those of the control group. The urinary levels of VOC metabolites, including N-acetyl-S-(2-carbamoyl-ethyl)-L-cysteine (AAMA), N-acetyl-S-(2-carbamoyl-2-hydroxyethyl)-L-cysteine, N-acetyl-S-(4-hydroxy-2-buten-1-yl)-L-cysteine-3, trans, trans-muconic acid (t,t-MA), and S-phenylmercapturic acid (SPMA) increased as the urinary levels of cotinine increased. Relevant dose-response relationships between the risk of UC risk and the urinary levels of AAMA, t,t-MA, SPMA, and 8-OHdG were found after adjusting for potential risk factors. The UC risk of participants with high urinary levels of cotinine, AAMA, t,t-MA, SPMA, and 8-OHdG were 3.5–6-fold higher than those of other participants. Increased urinary levels of VOC metabolites were associated with smoking-related UC risk. The development of UC should be explored in large-scale in vitro or in vivo studies with the repeated measurement of VOC metabolites.

Keywords : volatile organic compound, urothelial carcinoma, cotinine, 8-hydroxydeoxyguanosine

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