ABSTRACT

Background: Previous studies have shown that increasing breast density is associated with an increased risk of breast cancer. Breast density is affected by several endogenous and exogenous factors, and there have also been reports of geographic variations. Geographic variations in breast density may be due to differences in lifestyle and diet, as well as environmental factors such as air pollution exposure. However, these environmental contributors have not been clearly established. The objective of this study was to determine the association between air pollution and mammographic breast density among postmenopausal women who had undergone screening mammography in Tokyo, Japan.

Methods: The study population for this study were postmenopausal women who had undergone screening mammography at St. Luke's International Hospital Center for Preventive Medicine from April 2004 to September 2018. For exposure, the ambient air pollution ($PM_{2.5}$) density of the locations of interest, namely, the patients' residential areas during the study period, were obtained from the official website of the Bureau of Environment of the Tokyo Metropolitan Government. The mean $PM_{2.5}$ exposure levels for 1, 3, 5, and 7 years were determined. For the outcome, the BI-RADS categorical classification of every individual's mammography results were obtained from electronic charts. A logistic marginal model for longitudinal data was used to examine the association between air pollution density and categorical data on mammographic breast density.

Results: A total of 44,280 women were included in this study and of them 29,135 were classified in the not highly dense group (BI-RADS categories 1 and 2), and 15,145 in the highly dense group (BI-RADS categories 3 and 4). There was a 3% increase in the odds of having higher breast density after 1 year (OR = 1.027, 95% Confidence Interval (CI) 1.019– 1.034) and 3 years of $PM_{2.5}$ exposure (OR = 1.029, 95% CI 1.022– 1.036). This further increased to 4% at 5 years exposure (OR = 1.044, 95% CI 1.037– 1.052), and 5% at 7 years exposure (OR = 1.053, 95% CI 1.044– 1.063). Subgroup analysis showed that the risk for high breast density increased if the factors of smoking, family history of breast and/or ovarian cancer, and history of childbirth were present.

Conclusion: This study is the first study that examines the association between $PM_{2.5}$ exposure and mammographic breast density in an Asian study population. We found a positive association between $PM_{2.5}$ and mammographic breast density, and the strength of the association increased with increasing duration of exposure.