

Alteration of Sleep Stages in Obstructive Sleep Apnea Syndrome affected by Air Pollution

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Background

Several studies have demonstrated an relationship between obstructive sleep apnea syndrome (OSAS) and air pollution. However, the mechanism between air pollution effect on sleep stages in OSAS remain unclear.

Objective

The objective of this study is to determine the effect of air pollution on sleep stage in OSAS.

Methods

Subjects were recruited with diagnosis of OSAS in a sleep center in New Taipei city (Taiwan) from 2006 to 2012. According to the American Academy of Sleep Medicine (AASM) guideline, OSAS severity were classified into four degrees by apnea and hypopnea index (AHI). Sleep stages were scored to non-rapid eye movement (NREM) and rapid eye movement (REM) stages manually by trained sleep technologists according to the AASM guideline. Air pollution data were obtained from 25 monitoring stations (operated by the Taiwan Environmental Protection Administration, Taiwan) throughout northern Taiwan. The daily concentrations of air pollutants were collected for 1-year average exposure, corresponding to subject exposure. Liner regression model was used to determine the association between air pollution and the ratio change of NREM and REM in subjects with severe OSAS. Age, sex and body mass index were adjusted in the models.

Results

5,254 subjects were enrolled in this study, including 1,103 of normal degree, 980 of mild degree, 989 of moderate degree, and 2,182 of severe degree respectively. Decreased 0.07 percentage of NREM in total sleep time were correlated to increase 1-unit of particulate matter of <2.5 μm in aerodynamic diameter (PM_{2.5}) (95%CI: -0.26~-0.05; p-value < 0.01). Each increase 1-unit of PM_{2.5} was decreased 0.07% of REM in total sleep time (95% CI: -0.73~-0.13; p-value <0.01). In terms of Nitrogen dioxide (NO₂), the percentages of NREM in total sleep time were increased 0.06% with increase per 1-unit of NO₂ (95%CI: 0.03~0.27; p-value = 0.02), whereas the proportions of REM in total sleep time were increased 0.07% with increase per 1-unit

of NO₂ (95%CI: 0.01 ~ 0.08; p-value = 0.01).

Conclusions

Significant effects of air pollution on sleep stages were observed in OSAS subjects.

Keywords: air pollution, NREM, obstructive sleep apnea syndrome, REM, sleep stage.

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