Joint meeting

The 7th International Symposium on Neurocardiology

NEUROCARD 2015

The 6th International Symposium on Noninvasive Electrocardiology

SCIENTIFIC PROGRAM & BOOK OF ABSTRACTS

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University Press Târgu Mureş
2015

October 16th – 17th, 2015
National Library of Serbia, Belgrade, Serbia

NEUROCARD
ISSN 2069-0169
ISSN-L 2069-0169
published by
University Press Târgu Mureş

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Organized by:

Serbian Neurocardiological Society, SNCS

Serbian Autonomic Society, SAS

Under auspices:

International Society for Holter and Noninvasive Electrocardiology (ISHNE)

Meeting endorsed by:

International College of nutrition
International College of Cardiology
Russian Society for Holter Monitoring and Noninvasive Electrophysiology
Russian Society of Cardiologists
Polish Society for Noninasive Electrocardiology
Ukraine Neurocardiological Society
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Serbian Association for Arteriosclerosis, Thrombosis and Vascular Biology Researsh under auspicies of International Arteriosclerosis Society, IAS
Cardiology Society of Serbia, CCS

Under Patronage

Clinical Hospital Center Bezanijska Kosa
Republic of Serbia Ministry of Health
Republic of Serbia Ministry of Science and Tehnological Development
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Serbian Medical Society

O4 Gene polymorphisms related to cardiac autonomic response to particulateair pollution and oxidativestress

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Genetic susceptibility is likely to play a role in response to air pollution. There are numeros studies which have examined gene–environment interactions in relation to the autonomic nervous system (ANS) and cardiovascular health effects of air pollutants. Changes in heart rate variability (HRV) may reflect changes in cardiac autonomic function and risk of sudden cardiac death. Particulate-related changes in autonomic nervous system activity, suggesting sympathetic activation or vagal suppression after particulate air pollution exposure, have been observed in both experimental animal studies (1, 2) and human studies (3-7). A number of studies in a recent meta-analysis support an inverse association between PM exposure and heart rate variability (8). Exposure to the highest concentration of PM induced changes in markers of HRV variability (increased root of the mean of squared differences of adjacent RR intervals (RMSSD), low frequency (LF), high frequency (HF, and decreased LF/HF), and attenuated myocardial micro-RNA (RNA that suppress translation by targeting messenger RNA) expression (2). The effects of PM2.5 on subjects with hypertension were larger than on the subjects without hypertension (9). PM-induced decreases in ANS control of heart rate and increase of the risk of arrhythmia and acute cardiovascular events, may be more pronounced in older people (3). Recent study suggest that oxidative stress and systemic inflammation could be modifiers of cardiac autonomic responses to particulate air pollution (10). Air pollution effects on reduced SDNN are stronger in subjects with elevated systemic inflammation (11).

A number of anti-oxidant related genes have been identified and several studies have examined the degree to which polymorphisms in these genes may modify responses to PM.Polymorphisms in genes coding for glutathione S-transferase enzymes (GSTM1, GSTP1, GSTT1) were examined most often but variants in genes for heme oxygenase-1 (HMOX-1), hemocromatosis (HFE), NAD(P) H dehydrogenase [quinine] 1 (NQO1), and catalase (CAT) were also examined. Several studies have reported that individuals carrying the null allele for GSTM1, an enzyme that plays a key role in the cellular defense against oxidants, are more responsive to PM (12-15). An association was reported between PM concentration and decreased HRV in individuals with the null GSTM1 allele (15). Borderline significant effect for GSTT1polymorphism in association with PM2.5 exposure with increased plasma homocysteinemia was found (16). Also polymorphisms in genes related to lipid or cholesterol metabolisms could modify the effects of the exposure to PM2.5 on HRV. The apolipoprotein E (APOE, G113C), lipoprotein lipase (LPL, 291S, D9N) and vascular endothelial growth factor (VEGF, G634C) significantly modified effects of PM2.5 on HRV(17). Molecules involved in immunoresponses are attractive as potential modulators of cardiovascular pathology following PM exposure. Toll-like receptors (TLRs), a group of receptors abundantly expressed on leukocytes, have emerged as crucial first-responders linking innate and adaptive immunity after environmental challenge. Higher TLR2 methylation may confer susceptibility to adverse cardiac autonomic effects of PM2.5 exposure in older individuals (18). Higher flavonoid intake may attenuate these effects, possibly by decreasing TLR2 methylation (18). PM-induced cardiac dysfunction is mediated by multiple mechanisms.

In general, stronger inverse associations were observed between PM2.5 and HRV among subjects with genetic polymorphisms that impaired oxidant defence. The anti-oxidant supplementation was found to reduce inverse associations between PM2.5 and both time and frequency-domain measures of HRV (19).

Gene-environment interactions studies can help explore the mechanisms and the potential pathway in the association between air pollution and a cardiovascular outcome. Here we review studies that explore the impact of polymorphisms in anti-oxidant related genes or anti-oxidant supplementation on PM2.5-induced cardiorespiratory outcomes in an effort

to summarize existing evidence related to oxidative stress defence and cardiac autonomic response and the health effects of PM2.5.

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