Environmental noise and arterial stiffness in the context of hypertension

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Introduction: Environmental noise has a documented influence on the development of hypertension and its complications. Hypertension and aging are the main reasons for the of arterial stiffness progression, phenomena with a remarkably unfavorable impact on the prognosis.

Aim: The aim of our study was to assess the impact of long-term exposure to aircraft noise on blood pressure profile and selected subclinical organ damage of hypertension with special emphasis on arterial stiffness.

Material and methods: We conducted an observational study near Krakow, Poland. In the group of people living in the area exposed to high aircraft noise levels, > 60 dB Lden, and in the unexposed group, <55dB Lden, we carried out questionnaire survey, we measured BP values from office (SBP, DBP) and 24h ABPM settings (SBP and DBP for 24h, night and day time) as well as carotid-femoral pulse wave velocity (PWV) from pulse wave analysis. Further on, we compared groups within considered parameters and fitted linear regression models to assess the impact of individual variables on PWV.

Results: The exposed (n=101) and unexposed (n=100) group did not differ in terms of age (53.9 ± 8.2 vs. 53.6 ± 8.5 yrs, p = 0.90), BMI (27.2 ± 4.3 vs 27.7 ± 4.7 kg/m2, p = 0.41), gender ratio (64% vs 71% women, p = 0.39) and prevalence of hypertension (52.5% vs 50%, p = 0.83). Office and nighttime DBP values were significantly higher in the group exposed to environmental noise (88.3 ± 11.4 vs 79.8 ± 8.6, p <0.001, 66.6 ± 9.5 vs 63.6 ± 7.3, p = 0.01). The remaining BP parameters analyzed did not differ between the groups. We observed significantly higher values of the PWV index in the exposed group (10.3 ± 1.8 vs 9.4 ± 1.4 m/s, p <0.001), and the differences were particularly marked among normotensives. In this group, the typical age-related increase in PWV was blunted. The 40-year-olds presented the PWV level equal to those of the second decade older. The degree of PWV increase was dependent on the subjective aircraft noise annoyance assessment. In the linear regression model including exposure to noise, age, SBP and DBP, the first variable was an important predictor of the increase in arterial stiffness index (β = 0.26, R2 of the model = 0.36, p <0.001).

Conclusions: Long-term exposure to aircraft noise in the place of residence is associated with accelerated development of arterial stiffness, even in the group of people without hypertension. The association of pulse wave velocity increase with the degree of perceived noise annoyance may suggest that underlying pathomechanism is the stress reaction of the organism to sound stimuli.