Association between road traffic noise exposure and cortisol metabolites in newborns

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ABSTRACT

Several epidemiological studies provide strong evidence for non-auditory health effects of transportation noise, which may be mediated by a noise-induced release of stress hormones. With data from a prospective birth cohort in the region of Bern, Switzerland, we aimed to investigate whether road traffic noise exposure has an effect on postnatal stress. We used adjusted multivariable linear regression models to estimate the association between modelled residential road traffic noise exposure and cortisol metabolite concentrations measured in urine of 165 one-month-old infants.

1. INTRODUCTION

The association between road traffic noise and several non-auditory health effects is well documented in scientific literature [1-3]. A possible biological mechanism suggests a noise-induced overproduction of stress hormones, which in turn affects many physiological functions in the human body [4]. Although the association between transportation noise exposure and an increased release of stress-related hormones is well reported in children and adults [5-7], no study to date has investigated this association during prenatal and early postnatal life.

Therefore, the objective of this study was to investigate the association between modelled residential road traffic noise exposure and cortisol metabolite concentrations in urine of 165 one-month-old infants.

2. METHODS

The assessment of road traffic noise exposure was based on spatially detailed modelled data for the year of 2011 from the SiRENE (Short and Long Term Effects of Traffic Noise Exposure) study [8]. The SiRENE database includes information on road traffic noise estimated at façade points for all buildings in Switzerland.

Individual level exposures at the home address were assigned to a subgroup of 165 one-month old healthy infants from the ongoing Basel-Bern Infant Lung Development (BILD) birth cohort, recruited antenatally between 2005 and 2011. Steroid levels were determined by gas chromatography-mass spectrometry after parents provided diapers with clean urine from their newborn. The study was approved by the Ethics Committee of Bern, Switzerland and written informed consent was obtained from parents before enrollment.

We used linear regression models to estimate the association between modelled residential road traffic noise exposure and concentration of nine cortisol metabolites. Noise levels (Lden in dB) were categorized into tertiles, i.e. low (reference category), medium and high exposure. Models were adjusted for family and pregnancy history and exposure to NO_2, and results were expressed as percent change (and 95% confidence interval) between the medium or high exposure category in comparison to the reference (i.e. low exposure).

3. RESULTS

Newborns exposed to highest noise levels showed a borderline significant increase (defined as p-value<0.1) in the concentration of cortisone (%change = 22.6% [-1.8 – 53.0%], p-value = 0.074) and β-cortolone (%change = 51.5% [-0.9 – 131.5%], p-value = 0.057). On the contrary, borderline negative associations were found between road traffic noise and tetrahydrocortisol (%change = -23.7% [-42.8 – 1.9%], p-value = 0.069) and α-cortolone (% change = -18.3% [-33.6 – 0.6%], p-value = 0.059) for newborns in the high exposure category. No significant associations were found for the following metabolites: cortisol, 5α-tetrahydrocortisol, α-cortol, β-cortol and tetrahydrocortisone.

4. CONCLUSIONS

Our results show an association between road traffic noise exposure in the high category and the concentration of four cortisol metabolites measured in urine of 165 newborns. The alteration of cortisol metabolite levels may indicate noise as a potential stressor in early postnatal life. Since physiological parameters during childhood were not assessed in this study, the physiological meaning of this finding in regard to the onset of health disorders during infancy needs to be further investigated.

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