

Decreased airway epithelial sodium transport in chronically hypoxemic patients with cyanotic congenital heart defect

Kaskinen A., Helve O., Andersson S., Rautiainen P., Mattila I., Pitkänen O.

Children's Hospital, Helsinki University Central Hospital and University of Helsinki Helsinki, Finland

Introduction:

Recovery from congenital cardiac surgery may be interfered by pulmonary complications such as pulmonary edema. Transepithelial lung edema reabsorption rests on airway epithelial sodium transport from the lung lumen towards the blood space through sodium channels (ENaC). ENaC comprises three homologous subunits (α , β , γ), and is inhibited by the diuretic agent amiloride. ENaC activity is impaired by hypoxia, which has been shown in vitro and in humans in high altitude pulmonary edema. The effect of chronic hypoxemia on airway epithelial ion transport, however, has not been studied. □

Material and methods: We studied 26 hypoxemic ($\text{SpO}_2 \leq 85\%$) patients with cyanotic congenital heart defect (Cy-CHD) and 21 normoxemic ($\text{SpO}_2 \geq 95\%$) patients with acyanotic CHD (Acy-CHD). The activity of airway epithelial sodium transport was assessed by transepithelial nasal potential difference (N-PD) during locally perfused saline-solution (N=37). After recording of the maximal basal N-PD, the contribution of ENaC to this resting N-PD was tested by inhibiting sodium transport with amiloride perfusion (10^{-4} M). Relative α -, β - and γ -ENaC mRNA expressions were determined by real time RT-qPCR in samples taken from nasal respiratory epithelium (N=41). Data are given as mean \pm SD or median with range, and statistical analyses were performed with T-Test or Mann-Whitney U Test, as appropriate ($P < 0.05$ considered statistically significant). □ □ Results: Basal N-PD was significantly less negative in Cy-CHD (-12, range -21 – -7 mV) than in Acy-CHD (-15, range -24 – -7 mV) (Figure 1). Amiloride inhibitable sodium transport was significantly lower in Cy-CHD (4, range 0 – 11 mV) than in Acy-CHD (10, range 1 – 17 mV) (Figure 1). Relative expressions of α -, β - and γ -ENaC, however, did not differ significantly between Cy-CHD (α 1.29 ± 0.35 , β 0.90 ± 0.48 , γ 1.21 ± 0.86) and Acy-CHD (α 1.13 ± 0.33 , β 0.82 ± 0.34 , γ 0.99 ± 0.50). □ □ Conclusions: Our findings provide evidence that chronic hypoxemia impairs amiloride sensitive airway epithelial ion transport activity without significant effect on ENaC-subtype expression. Defective lung fluid reabsorption may predispose patients with cyanotic CHD and chronic hypoxemia to postoperative lung edema. □

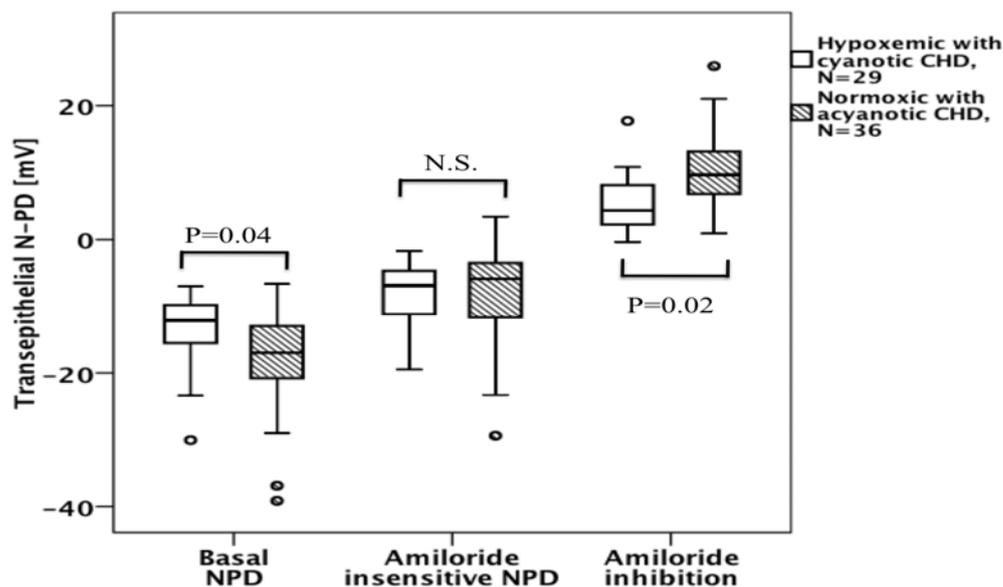


Figure 1.