6) Cardiovascular Effects of Acute Exposure to Ozone on SHR

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Effects of inhalation of environmental pollutants, such as ozone ($O_3$), on cardiac function have not been well detected. We previously reported that acute exposure ($1$ ppm, 3 hours) produced evident effects on the cardiovascular functions of rats.

Materials and Methods

11-weeks-old male rat (JCL: Wistar) (C group) and 12-weeks-old male SHR (S group) 6 and 10 of each were used. A catheter was introduced into the femoral artery and an electrode for ECG was attached for anesthetized rats 24 hours before the exposure to $O_3$. The rats were exposed to $O_3$ (1 ppm) in a cubic stainless-steel chamber for 3 hours. ECG and arterial pressure were recorded during exposure. Heart rate per minute was counted from the number of R wave for 10 second and the value of arterial pressure calculated the mean pressure.

Results

Before the exposure to $O_3$, heart rate of C and S groups were $425 \pm 47 \text{ min/sec (mean \pm SD)}$ and $393 \pm 21 \text{ min/sec}$, respectively: the difference was significant ($p<0.05$). Fig. 1 shows percent change in heart rate of rats during exposure. Immediately after the start of exposure, a transient elevation in heart rate was observed in 7 rats of S group, but only 2 rats of C group. Then heart rate decreased steadily in the both groups. Heart rate of C group reached to the plateau, 45% of the initial level, 90 min after the start of exposure. On the other hand, heart rate of S group decreased more slowly than did C group, and reached to 66% of initial level 90 min after the start exposure. Heart rate was $197 \pm 16 \text{ min/sec (46.7 \pm 5.3\%)}$ and $224 \pm 17 \text{ min/sec (56.9 \pm 4.0\%)}$, respectively, 3 hours after the start of exposure: the difference was significant ($p<0.01$).

Before the exposure to $O_3$, arterial pressure of C and S groups were $131.3 \pm 8.6 \text{ mmHg}$ and $169.8 \pm 12.5 \text{ mmHg}$, respectively. Similarly to the heart rate, the decrease in arterial pressure was observed in the both groups. Although arterial pressure of C group more rapidly decreased during the early period than did S group, it was 80% of the initial level in the both groups at the end of exposure.

On the tracing of ECG, the significant increase in PQ interval and premature atrial contraction were observed. Additionally, II A-V block (Wenchebach type) was observed in 4 rats of C group and 2 rats of S group.

Discussion

Mechanisms for the effects on cardiovascular functions of rats by the exposure to $O_3$ still remained to be studied. The responses of SHR to the exposure to $O_3$ suggests that the participation of cathecholamine appears probable.