INTRODUCTION

Many studies have been reported about the hemodynamics of SHR in anesthetized states. However, there have been only a few reports in awake states. In this study, cardiac output (CO) was measured in awake states using thermodilution method.

MATERIALS AND METHODS

Study I: Studies were performed on 10 male WKY aged 3-8 month-old. One catheter was inserted into left femoral artery and another catheter was inserted into right atrium through right jugular vein. The thermister was placed in ascending aorta through right carotid artery. 2.0 mm electromagnetic flow probe was placed around ascending aorta without incising the pleura. CO was determined by thermodilution, using Columbus Cardiotherm 500-R. Saline of room temperature (100 μl) was injected into right atrium. The procedure was repeated 5 times every one minute, and obtained data were averaged except for the first one.

Study II: Materials were 8 young SHR (3 month-old), 8 WKY (age matched), 5 adult SHR (6 month-old) and 5 WKY (age matched). Cannulation was performed as Study I. After 24 hours' rest, measurements were performed in plexiglass cage to which the rats had been habituated. After placing the rats in plexiglass for 30 minutes, resting mean arterial pressure (MAP), heart rate (HR) and CO were measured.

RESULTS

Study I: CO were 37.5 ± 7.2 ml/min/100g and 29.2 ± 7.3 ml./min/100g by thermodilution method and electromagnetic flow method, respectively. Correlation coefficient was 0.66. Regression equation was as follows:

\[ Y = 0.59X + 12.58 \]

Y: electromagnetic flowmetry, X: thermodilution method

Study II: In young rats, MAP, total peripheral resistance (TPR) and the ratio of heart work to the body weight (HW/BW) were significantly elevated in SHR as compared with in WKY. Similarly, the ratio of LV weight to BW (LV Mass/BW) was definitely higher in SHR than in WKY. No difference in HR, CO and stroke volume (SV) was obtained between two groups, though SHR showed a tendency to higher HR. The ratio of CO to LV Mass (CO/LV Mass) was significantly decreased in SHR as compared with WKY. In adult rats, BW was significantly lower in SHR than in WKY. MAP and TPR were significantly elevated in SHR as compared with WKY. SV and CO/LV Mass were significantly lower in SHR than in WKY. LV Mass/BW in SHR was increased significantly as compared with WKY. There were no differences in HW/LV Mass and HR between two groups, though SHR had a tendency of higher HR and lower HW/LV Mass.

DISCUSSION

CO by thermodilution method was overestimated as compared with one by electromagnetic flowmetry, because the heat capacity of blood was radiated during the passage of injected saline through pulmonary capillaries. However, thermodilution method is more simple than other methods. Therefore this method is useful to measure CO in awake states.

In SHR aged 3 and 6 month-old, CO/LV Mass was decreased significantly as compared with WKY, though in CO/BW there was no difference between these groups. This suggests that in young and adult SHR, the pumping ability to LV Mass was decreased as compared with WKY. On the other hand, in 3 and 6 month-old SHR there was no difference in HW/LV Mass between two groups. The results suggest that the development of LV Mass in SHR adapted to heart work, not to pumping ability, at the same level as WKY.