Impaired an Arterial Baroreflex Function in Prehypertensive and Hypertensive Spontaneously Hypertensive Rats.

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Objective: Previous studies have shown that arterial baroreceptor reflex control of sympathetic nerve activity is blunted in salt-dependent hypertensive model in prehypertensive stage(such as Dahl-S and DOCA-salt rats). The arterial baroreflex control of sympathetic nerve activity in prehypertensive SHR, a genetic model of hypertension, has been little known. This study tested the hypothesis that there is impairment in arterial baroreflex function in conscious SHR. We recorded the lumbar sympathetic nerve activity(LSNA) in prehypertensive SHR and WKY during phenylephrine injection under unanesthetized and free-moving conditions.

Methods: This study was performed in 5-week old(Prehypertensive;n=6) and 10-week old(hypertensive;n=6) SHR, 5-week old(n=6) and 10-week old(n=5) Wistar-Kyoto rats(WKY). After anesthetized with sodium pentobarbital, bipolar stranded stainless steel electrodes were placed around the lumbar sympathetic nerve, and femoral artery and vein catheters were externalized between the scapulae. After 2days of operation, the changes of LSNA, mean arterial pressure(MAP) and heart rate(HR) were recorded during phenylephrine injection(15-40 microgram/Kg/min.). The signals from LSN were amplified($\times 20,000$) and filtered(low frequency, more than 30Hz, high frequency, less than 1,000Hz). LSNA was expressed as percent change from baseline nerve activity. The linear portion of the curves relating the LSNA and HR to change in MAP were analyzed by linear regression during phenylephrine-induced change in MAP. The slopes of these regression lines, used as an index of baroreflex sensitivity, were compared by ANOVA.

Results: The resting MAP were 104 ± 4 mmHg(5-week old) and 139 ± 16 (10-week old) in SHR, 103 ± 4 (5-week old) and 92 ± 16 (10-week old) in WKY(mean $\pm$ SEM). There was no significant difference in MAP between 5-week old SHR and WKY. The slopes of LSNA-MAP linear regression relationship during phenylephrine injection were significantly blunted in prehypertensive and hypertensive SHR than age-matched WKY(5-week old SHR; $-0.46 \pm 0.13\%/mmHg$, 5-week old WKY; -1.02 ± 0.18 $p < 0.05$; 10-week old SHR; -0.18 ± 0.09 , 10-week old WKY; -0.75 ± 0.16 $p < 0.05$). The slopes of HR-MAP relationship were also significantly blunted in SHR than age-matched WKY(5-week old SHR; -1.7 ± 0.5 bpm/mmHg, 5-week old WKY; -4.8 ± 1.2 $p < 0.05$; 10-week old SHR; -1.2 ± 0.7 , 10-week old WKY; -2.4 ± 0.1 $p < 0.05$). There were no significant differences in the slopes of HR-MAP and LSNA-MAP relationship between 5-week old and 10-week old SHR.

Conclusion: These data suggested that an arterial baroreflex control of sympathetic nerve activity and heart rate were impaired in both prehypertensive and hypertensive stages in SHR. Therefore, a genetic defect may be primarily responsible for the arterial baroreflex dysfunction in SHR, and impaired arterial baroreflex function in prehypertensive stage would contribute to the onset and development of hypertension in SHR.