The interaction between renin-angiotensin system and sympathetic nervous system in the systemic circulation of conscious Sprague-Dawley rats

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Abstract

Experiments were carried out in conscious, unrestrained, male rats to evaluate possible interactions between the renin-angiotensin system and the sympathetic nervous system in the systemic circulation upon the intravenous administration of angiotensin II and a set of adrenergic agonists. Sixteen Sprague-Dawley rats with matched body weight received intraperitoneal injection of reserpine (5mg/kg) one day before the rats were subjected to baseline measurements of mean arterial blood pressure and heart rate before receiving bolus intravenous doses of noradrenaline, phenylephrine, methoxamine and angiotensin II that caused an immediate fall in the blood pressure of these rats. The animals were allowed to move freely during experiments. Dose-response curves were established for angiotensin II and adrenergic agonists-induced increase in mean arterial blood pressure. The results showed a significant (P<0.05) enhancement of the vascular responsiveness to noradrenaline, phenylephrine, methoxamine and Angiotensin II in the systemic vasculature of conscious rats. Reserpine enhanced the sensitivity of both vascular α₁-adrenoceptors and AT₁ receptors to the vasoactive agents. The results obtained also demonstrate that angiotensin II-induced systemic vasoconstriction is contributed to by adrenergic actions, and that there is a possible interaction between Ang II receptors and adrenergic neurotransmission in conscious Sprague-Dawley rats.

Key words: α₁-adrenoceptors; angiotensin II; renin-angiotensin system; Sprague-Dawley rat; reserpine.

Introduction

The mechanisms of various interactions between the renin-angiotensin system and the sympathetic system have been established at different levels and have been shown to bear prominent pathophysiological implications. Unfortunately, most of the studies that examined these interactions were done in anaesthetized rats. Indeed, it will be very interesting to see these interactions in conscious unrestrained rats. Apart from an important regulatory influence, systemic blood pressure and intravascular volume regulation are also modulated by the actions of the renin-angiotensin system (RAS). Circulating angiotensin II itself can interact with the sympathetic nervous system (SNS) at various sites and is believed to influence sympathetic nerve activity. It acts at presynaptic sympathetic nerve endings to facilitate sympathetic neurotransmission (1,2) and, hence, facilitates sympathetic influences on the systemic circulation (3).

The interaction between catecholamines and angiotensin II at the vascular level is particularly