Enhanced release of noradrenaline in the kidney of the young spontaneously hypertensive rat

M. G. COLLIS, C. DE MEY AND P. M. VANHOUTTE

Department of Medicine, Universitaire Instelling Antwerpen, Wilrijk, Belgium

Summary

1. Vascular reactivity and noradrenaline overflow were studied in Tyrode solution-perfused kidneys from young (6 weeks) normotensive and spontaneously hypertensive (SH) rats.

2. The vasoconstrictor response to nerve stimulation was greater in the kidneys from young SH rats than in those from young control rats.

3. Nerve stimulation evoked a greater release of noradrenaline in the kidneys from young SH rats than in those from normotensive animals.

4. The results demonstrate that the renal sympathetic nerves release more noradrenaline than normal in the young SH rats, which could be an important factor in causing hypertension.

Key words: noradrenaline release, renal nerves, renal perfusion, spontaneous hypertensive.

Abbreviation: SH, spontaneously hypertensive.

Methods

Six 6-week-old SH rats were compared with six control rats of the same age; the control group consisted of three Wistar-Kyoto and three inbred Wistar rats. The systolic blood pressure was measured by a tail-cuff method.

Rats were anaesthetized with pentobarbitone sodium (50 mg/kg, intraperitoneally) and the abdomen was opened by midline incision. The aorta adjacent to the left renal artery was cannulated, and the kidney perfused with Tyrode solution (2 ml min⁻¹ g⁻¹; 37°C). The perfused kidney was removed from the rat and placed in a chamber containing Tyrode solution. A constant-flow perfusion pump was used, and changes in renal vascular resistance were recorded as increases in perfusion pressure (Collis & Vanhoutte, 1977). The renal nerves were stimulated by peri-arterial electrodes (6 or 16 Hz, 2 ms, 10V). Periarterial nerve stimulation was applied during 2 min at 6 Hz and 15 min later during 2 min at 16 Hz.

Samples of perfusate were collected into cooled test tubes during 2 min periods before, during and after the stimulation. These samples were analysed for noradrenaline, adrenaline and dopamine by radioenzymatic assay (Peuler & Johnson, 1977). Student's t-test for paired and unpaired observations was used to evaluate differences between means; P < 0.05 was considered significant.

Results

The systolic blood pressure was significantly higher in the SH rat than in the control animals (158.3 ± 2.6 and 119.5 ± 1.1 mmHg respectively). There were no significant differences in basal perfusion pressure and basal noradrenaline efflux between the two groups.
Electrical stimulation (6 and 16 Hz) evoked significantly greater vasoconstrictor responses and larger increases in the efflux of noradrenaline from the kidneys of SH rats than from those of the normotensive control (Fig. 1).

No adrenaline and no dopamine could be detected in the perfusate from kidneys of either SH or normotensive rats.

**Discussion**

The results of this study confirm the finding of increased renal vascular responsiveness to sympathetic nerve stimulation in the early stages of spontaneous hypertension (Collis & Vanhoutte, 1978). The increased reactivity is paralleled by an augmented overflow of adrenergic neurotransmitter. The present experiments thus provide direct evidence that more noradrenaline is released by the renal nerves upon stimulation in the young SH rat. This augmented release may be an important factor in increasing peripheral resistance and causing hypertension.

**References**

