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Adrenomedullary enkephalins are synthesized in the medullary chromaffin cells and stored with catecholamines (CA) in these cells. Enkephalins can be secreted in response to neurogenic stimulation, Ach and stress, agents that concomitantly release CA. Enkephalins inhibit the nicotinic release of CA from chromaffin cell cultures, probably acting presynaptic opiate receptors. In sympathetic ganglia, preganglionic stimulation reportedly produces presynaptic inhibition of cholinergic transmission in a naloxone inhibitory manner. In adult SHR and WKY, we found no difference in met-enkephalin (ME) levels in adrenals but increases in ME in superior cervical ganglia (SCG) of SHR in the previous meeting in 1982. The present study was designed to explore the responses of ME levels in adrenal and various sympathetic ganglia to acute alteration of aortic BP in SHR and WKY.

Adult SHR and WKY of 20 weeks of age were used. Angiotensin (AG) II 0.2 mg/kg s.c. dissolved in a chelator cocktail and phenylephrine (PE) 0.5 mg/kg s.c. were administered to elevating aortic BP by 50 mmHg, while hydralazine (HL) 5 mg/kg p.o. and prazosin (PZ) 1 mg/kg p.o. were given to SHR for lowering BP by 50 mmHg. ME levels were measured using a radioimmunoassay as described previously (Hypertension 4: 662-669, 1982).

Plasma ME levels appeared to be lower in SHR than in WKY, when aortic blood was collected from conscious rats at the resting state. Acute hypertension made by AG-II and PE significantly increased SCG ME (per ganglion and protein), while a BP fall induced by PZ decreased stellate ganglionic ME. Alteration of BP did not increase presynaptic ChAc activity in adrenals and sympathetic ganglia, except for the SCG of which ChAc was increased by AG-II, PE and PZ. In the adrenal gland, alteration of BP to either direction similarly increased ME levels per gland and protein. AG-II produced 2-fold increase in adrenal ME, while HL- or PZ-induced fall of BP did 3-fold increases in adrenal ME contents. BP alteration induced by these agents appeared to simultaneously increase plasma ME levels. Since splanchnic nerve stimulation is known to secrete ME from adrenals, accumulation of adrenal ME following a fall of BP after HL and PZ may be the result of activation of descending sympathetic outflow through the central mechanisms of baroreceptor reflex. To verify the role of the descending splanchnic nerves leading to the adrenals, the effect of denervation on adrenal ME was examined. Denervation significantly increased ME levels per adrenal of WKY in the next day, while more markedly increased ME levels per gland as well as protein in SHR. Denervation, however, increased adrenal protein more extently in WKY than in SHR. Denervation reportedly accumulates enkephalines and enkephalin containing polypeptides in rat adrenals, while reserpine increases ME contents, suggesting that ME is under preganglionic nerve control and associated with CA granules. Under the adrenal denervation, a BP fall induced by HL produced the increase in adrenal ME to the levels 30 - 50% less than that in the intact adrenals. Furthermore, denervation abolished HL-induced increase in adrenal PNMT but AG-II-induced increase persisted. These present findings indicate that increases of adrenal ME and PNMT after a BP fall may be due to enhanced splanchnic efferent impulses to adrenals. Denervation did not consistently alter AG-II-induced increases in adrenal ME and PNMT, indicating the direct stimulating action of AG-II on the adrenal ME- and epinephrine-containing neurons.

In conclusion, a BP-rise in WKY accumulates ME in SCG to presynaptically further inhibit the centrally mediated depressed cholinergic transmission, while a BP-fall in SHR markedly increases adrenomedullary ME to inhibit the nicotinic release of catecholamines from medullary chromaffin cells and action of catecholamines released to circulation. Angiotensin II directly activates adrenal met-enkephalinergic and adrenergic neurons.