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EFFECTS ON CARDIOVASCULAR RESPONSES BY STIMULATION AND LESIONS OF THE AMYGDALA IN RATS

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Marked changes of sympathetic nerve activity are induced under mental stress, such as encounter with an enemy. Although the amygdala has been known as a negative emotion center for processing fear conditioning and coordination of defensive behaviors, its functions in autonomic control remain unclear.

In the present study, we examined cardiovascular responses induced by electrical and chemical stimulation of the unilateral amygdala in urethane-anesthetized rats. In addition, to test whether the amygdala also involves to cardiovascular regulation in waking state, we assessed the effects of bilateral amygdala lesions on daily arterial pressure (AP) fluctuations in free-moving rats in the home cage using telemetry. Electrical microstimulation of the central nucleus of the amygdala (CeA) induced gradual increase in AP and heart rate (HR), whereas stimulation of adjacent nuclei, including the basolateral amygdala, evoked a phasic AP decrease.

The gain of the baroreceptor reflex maintaining cardiovascular homeostasis was not altered by CeA stimulation, suggesting that the CeA activity increases both AP and HR by resetting baroreceptor reflex function. Disinhibition of GABAergic input by amygdalar microinjection of the GABA_A receptor antagonist bicuculline methiodide induced robust increases in AP and HR, consistent with responses to electrical stimulation of CeA. Furthermore, bilateral electrolytic lesions of CeA evoked consistent AP increases over the light/dark cycle.

These results suggest that the amygdala exerts bidirectional autonomic control over the cardiovascular system, and may contribute to defensive behaviors under stress.

Key words: the central nucleus of the amygdala, GABA, arterial pressure