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Potential role of the amygdala and the posterior claustrum in blood pressure regulation during high-intensity exercise

(高強度運動時の血圧調節における扁桃体と尾側前障の役割)

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### Abstract

Exercise leads to a physiological high-arousal state, which activates cardiovascular responses and facilitates behavioural performance. However, neuronal mechanisms linking the arousal state and autonomic regulation are poorly understood. The amygdala and claustrum (CL) are known as brain areas involved in emotional arousal, attention, sensory-motor coordination and cardiovascular control. Here, we investigated the existence and mechanism of the amygdala and CL-mediated coordinate regulation of the autonomic cardiovascular system during exercise. We used c-Fos immunostaining to examine whether the amygdala and CL are activated during treadmill exercise. Further, we investigated arterial pressure responses to the electrical microstimulation of the CL region exhibiting exercise intensity-dependent activation. We also confirmed the anatomical connections between the amygdala, CL, and the nucleus of the solitary tract (NTS) as a brainstem cardiovascular centre by retrograde tracer injections. Finally, we performed simultaneous electrical stimulation of the CL and amygdala to examine their functional connectivity. c-Fos expression was observed in the amygdala and the posterior part of the CL (pCL), but not the anterior part, in an exercise intensity-dependent manner. Microstimulation of the pCL induced a depressor response. Using a retrograde tracer, we confirmed direct projections from the amygdala to the pCL and NTS. Simultaneous microstimulation of the central nucleus of the amygdala and pCL showed a greater pressor response compared to the stimulation of the amygdala alone. The amygdala and pCL are functionally linked and may be coordinately involved in cardiovascular tuning that allows maintaining performance during high-intensity exercise accompanied by emotional arousal.