1. No.

   2021G010

2. Title

   The Role of Nicotinic Acetylcholine Receptors in the Central and Autonomic Nervous System Interaction

3. Period

   2021-2025

4. Summary

   This study aimed to clarify the neural mechanisms underlying autonomic cardiovascular regulation mediated by central–peripheral interactions of nicotine signaling. First, microinjection experiments demonstrated that nicotine, DOPA, and glutamate in the nucleus tractus solitarii (NTS) induced depressor and bradycardic responses. Optogenetic stimulation and selective neuronal ablation revealed that these cardiovascular responses were primarily mediated by vGlut2-positive glutamatergic neurons in the NTS.

   Further analyses showed that the electro-stimulation of autonomic afferent activated cholinergic neurons in the dorsal motor nucleus of the vagus (DMV), suggesting that cholinergic signaling modulates glutamatergic transmission involved in central cardiovascular responses. In addition, neural tracing experiments identified a feedback neural circuit between the nodose ganglion (NGV) and DMV. Cholinergic neurons in the DMV projected to the NGV, indicating a previously unrecognized central–peripheral feedback pathway.

   Functional experiments demonstrated that cholinergic stimulation in the NGV induced depressor and bradycardic responses, and these effects were mediated through glutamatergic neurotransmission in the NTS/DMV.

   Together, these findings suggest that nicotinic receptors and cholinergic signaling regulate baroreceptor reflex-related cardiovascular responses through glutamatergic neural circuits in the medulla. The identified neural pathways provide new insights into the mechanisms of central autonomic regulation and may contribute to an understanding of neural control of cardiovascular function.