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Commentary

Neurochemical Breathing Regulated Brain Stem Nuclei

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DESCRIPTION

The integrative brainstem network that underpins swallowing and other activities like as respiration has been partially understood through neurophysiological studies of the nuclei of the Nucleus Tractus Solitarius (NTS) and neighboring regions. Although the NTS is rich in neuropeptides and other neuroactive substances, little is known about how these compounds affect the neurons involved in swallowing in general. An enhanced understanding and focus on these regulatory mechanisms is required since their dysfunction in the NTS region may play a role in pathophysiological diseases such as dysphagia [1].

Glutamate, glycine receptors, choline acetyltransferase, serotonin, norepinephrine, and thyrotropin-releasing hormone are among the neurochemicals whose expression increases with age, while Gamma Amino Butyric Acid (GABA), serotonin receptor 1A, substance P, neurokinin 1 receptor, and somatostatin decrease. Glutamate, an excitatory neurotransmitter, and receptors decline rapidly, but GABA and glycine receptors rise rapidly. At the same time, cytochrome oxidase activity in respiratory neurons decreases. Interestingly, during P12, GABA receptors switch from a 3-dominant to a 1-dominant kind. The respiratory system may be vulnerable to failure under stress due to the transient dominance of inhibitory over excitatory neurotransmission [2].

In the complex intertwined process of respiration, the brain, brain stem, spinal cord, cranial and spinal nerves, diaphragm, intercostal muscles, laryngeal and pharyngeal structures, lungs, and vasculature all play important roles. It also incorporates a wide range of neurotransmitters, neuromodulators, receptors, second messengers, and transcription factors, the vast majority of which have only lately been studied. Several respiratory control mechanisms exist during the early postnatal, fetal, and adult stages of development. The idea is that the primary foci of neurochemical development of the respiratory network will show smooth aging-related trends in either rising or decreasing manifestations. This is not the case for neurochemicals found in a few postnatal brain stem nuclei. Three major regions that control respiration are located in the brain stem's pons, dorsal medulla, and ventrolateral medulla. The Pontine Respiratory Group (PRG), Dorsal Respiratory Group (DRG), and Ventral Respiratory Group (VRG) are the names given to these groups. The majority of the Para Brachial Lateral (PBL) and Para Brachial Medial (PBM) are made up of the PBL, PBM nuclei, and Kollicker-Fuse (KF) nuclei. It receives medulla input and participates in vocalization, diaphragmatic motor control, respiratory rhythm modulation, and airway muscle control during exercise and sleep. The principal representation of the DRG is the Ventrolateral Sub Nucleus (VSN), a crucial center of the NTS. The majority of neurons are inspiratory, and they fire in sync with bursts of phrenic nerve activity [3, 4].

Neurochemicals are the true mediators of sensory, motor, integrative, and modulatory processing in the respiratory network. Excitatory, inhibitory, cholinergic, monoaminergic, neuropeptide, hormone, nucleoside, neurotropic, transcriptional and enzyme neurotransmitters and neuromodulators are among them. Each of these neurochemicals has a unique collection of receptors that are essential for brain signal propagation. Yet, a lot more about these neurochemicals general roles than we do about their specific functions in controlling breathing or how they develop in brain stem respiratory nuclei. Neurochemicals are the real mediators of sensory, motor, integrative and modulatory processing in the respiratory network. Among them are excitatory, inhibitory, cholinergic, monoaminergic, neuropeptide, hormone, nucleoside, neurotropic, transcriptional and enzyme neurotransmitters and neuromodulators. Each of these neurochemicals has an own set of receptors that are required for brain signal propagation [5].

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