Cuneiform nucleus and Dorsomedial Hypothalamic nucleus and Perifornical area in the control of laryngeal activity and subglottic pressure in spontaneously breathing anaesthetized rats.

L. Carrillo-Franco[1,2,3], M. González-García[1,2,3], A. Díaz-Casares[1,3], C. Morales-Luque[1], M.V. López-González[1,2,3] and M.S. Dawid-Milner[1,2,3]

(1) Department of Human Physiology, Faculty of Medicine, University of Malaga, Malaga (Spain)
(2) Unit of Neurophysiology of the Autonomic Nervous System (CIMES), University of Malaga, Málaga (Spain)
(3) Biomedical Research Institute of Malaga (IBIMA Plataforma BIONAND), Malaga (Spain)

ABSTRACT

Background:

The dorsomedial hypothalamic nucleus and perifornical area (DMH-PeF) and the mesencephalic cuneiform nucleus (CnF) have been involved in sympathetic activity due their connectivity with several nuclei involved in cardiorespiratory control [dorsolateral periaqueductal gray matter, parabrachial/Kölliker-Fuse complex, solitary tract nucleus and the rostral ventrolateral medulla). In previous studies we have demonstrated a functional interaction between hypothalamic and mesencephalic structures with several rostral and ventral pontine structures that are involved in the changes of laryngeal caliber.

Objectives

To characterize the role of the DMH-PeF and CnF in modulating laryngeal activity and their effects on vocalization.

Methods

Experimental studies were carried out with male Sprague-Dawley rats (n=42) (250-300g). Animals were anesthetized with sodium pentobarbitone (60 mg/kg i.p., initial dose, supplemented 2 mg/kg, i.v.). Electrical stimulations (n=14) using concentric bipolar electrodes (1ms pulses, 20-40μA, 100Hz for 5s) microinjections of PBS-Evans Blue (250nl, pH 7.4±0.1, 5-s duration) (n=14) or glutamate (0,25M, 250nl) (n=14) were performed. Respiratory flow, pleural pressure, subglottic pressure, blood pressure and heart rate were also recorded.

Results

DMH-PeF and CnF PBS-Evans Blue microinjections did not produce any significant changes in any of the cardiorespiratory variables recorded. However, electrical stimulations in both regions evoked a decrease of laryngeal resistance (subglottal pressure) ($p<0,001$) accompanied with an inspiratory facilitatory response consisted of an increase in respiratory rate ($p<0,001$), together with a pressor ($p<0,001$) and tachycardic response ($p<0,001$). Glutamate microinjections within the DMH-PeF and CnF evoked a decrease of laryngeal resistance ($p<0,01$ and $p<0,001$ respectively) accompanied with an inspiratory facilitatory response consisted of an increase in respiratory rate ($p<0,001$ in both cases), together with a pressor ($p<0,001$ and $p<0,01$ respectively) and tachycardic response ($p<0,001$in both cases).

Conclusions

The results of our study contribute with new data on the role of the hypothalamic-mesencephalic neuronal circuits in the control mechanisms of subglottic pressure and laryngeal activity.

Keywords

Subglottic Pressure, Laryngeal Motoneurons, DMH-PeF, CnF, Nucleus Ambiguus