Cuneiform nucleus stimulation modifies laryngeal activity and subglottic pressure in rats

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The Cuneiform nucleus (CnF) of the mesencephalon has afferent and efferent connections with different regions of the CNS involved in cardiorespiratory control, i.e. dorsolateral part of the Periaqueductal Gray matter (dlPAG) and Parabrachial complex (PBc). In recent studies, we have characterized functional interactions between all these hypothalamic (DMH-PeF), mesencephalic (dlPAG) and pontine regions (PBc, A5 region) that are also involved in changes of laryngeal caliber, due to the abduction and adduction of the vocal folds controlled by motoneurons located in the caudal portion of the nucleus Ambiguus (Amb).

The aim of this study was to test the possible role of the CnF in laryngeal control and its effect on vocalization, and to characterize the electrophysiological relationships between the CnF and those pontine-medullary neuronal circuits involved in cardiorespiratory control and in changes of laryngeal caliber.

Experimental studies were carried out with non-inbred male rats (n=14), SPF, Sprague-Dawley (250-300 g) housed under standard conditions. Animals were anesthetized with sodium pentobarbitone (60 mg/kg i.p., initial dose, supplemented 2 mg/kg, i.v., as necessary). A double up and down tracheal cannulation was performed to measure subglottic pressure and airflow. Subglottic pressure was recorded with an aneroid transducer (Hugo Sachs Elektronik D-7801, ±0,1 psi) by passing a stream of humidified warm medical air upwards with a thermal mass digital air flow meter controller (Bronkhorst Hi-Tec F-201CV-AGD-22-V). Bilateral parietostomy allowed access to CnF. Microinjections of PBS-Evans Blue (250 nl, pH 7.4 ± 0.1, 5-s duration) or glutamate (0,25M, 250 nl) were performed. Respiratory flow, pleural pressure, blood pressure and heart rate were also recorded.

PBS-Evans Blue microinjections within CnF did not produce any significant changes in any of the cardiorespiratory variables recorded. However, glutamate microinjections within the CnF 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 ($p<0,01$) and tachycardic response ($p<0,001$).

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

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Keywords

Subglottic Pressure, Laryngeal Motoneurons, CnF, Nucleus Ambiguus

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