

LARYNGEAL EFFECTS OF STIMULATION OF THE DORSOMEDIAL HYPOTHALAMIC NUCLEUS AND PERIFORNICAL AREA IN SPONTANEOUSLY BREATHING ANAESTHETIZED RATS

M.V. Lopez-Gonzalez^{1,2}, M. Gonzalez-Garcia^{1,2}, L. Carrillo-Franco³, C. Carrillo-Franco³, A. Díaz-Casares^{1,2}, M.A. Barbancho¹ and M.S. Dawid-Milner^{1,2}

(1) Facultad de Medicina, Universidad de Málaga, Málaga (Spain).

(2) Unidad de Neurofisiología del Sistema Nervioso Autónomo (CIMES), Universidad de Málaga, Málaga (Spain).

(3) Facultad de Psicología y Logopedia, Universidad de Málaga, Málaga (Spain)

ABSTRACT

Background: Stimulation of the dorsomedial hypothalamic nucleus and perifornical area (DMH-PeF) in rats evokes a cardiorespiratory response characterised by an increase in blood pressure, heart rate and respiratory frequency. In previous studies (Díaz-Casares et al., 2012; López-González et al., 2018) we have shown a functional interaction between DMH-PeF and pontine structures (A5 region and Parabrachial Complex). We have also shown that rostral and ventral pontine structures are involved in the changes of laryngeal caliber (Lara et al., 2002). The aim of this study was to characterize the relations between hypothalamic and pontine neuronal circuits involved in laryngeal activity and its effect on vocalization.

Methods: Experimental studies were carried out with non-inbred male rats (n=7), 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 tracheal cannulation (upwards in direction of the glottis for the “glottis isolated in situ” technique, and downwards in the direction of the carina) was done. Subglottic pressure was recorded with an aneroid transducer (Hugo Sachs Elektronik D-7801, $\pm 0,1$ psi) by passing a stream of humidified medical air upwards through the larynx at a constant rate of 30-70 ml/min with a thermal mass digital air flow meter controller (Bronkhorst Hi-Tec F-201CV-AGD-22-V). Electrical stimulation of the DMH-PeF using concentric bipolar electrodes (1 ms pulses, 20-40 μ A, 100 Hz for 5 s) was performed. Respiratory flow, pleural pressure, blood pressure, heart rate and ECG activity were also recorded.

Results: DMH-PeF stimulation 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 a tachycardic response ($p < 0,001$).

Conclusions: The results of our study contribute with new data on the role of the DMH-PeF in the mechanisms controlling subglottic pressure and laryngeal activity.

Keywords

Subglottic Pressure, Laryngeal Motoneurons, dorsomedial hypothalamic nucleus and perifornical area, Rat.

Funding information: The study was supported by a program grant Junta de Andalucía, Grupo Consolidado nº CTS156, Spain. Part of the final study was supported with a grant from the University of Málaga.