LARYNGEAL EFFECTS OF STIMULATION OF THE CUNEIFORM NUCLEUS IN SPONTANEOUSLY BREATHING ANAESTHETIZED RATS

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ABSTRACT

Background: The cuneiform nucleus (CnF) is a mesencephalic area that has been involved in sympathetic activity due its connectivity with several nuclei involved in cardiorespiratory control, e.g. dorsolateral periaqueductal gray matter (dlPAG), the parabrachial/Kölliker-Fuse complex (PBc/KF), the solitary tract nucleus (NTS) and the rostral ventrolateral medulla (RVLM). In previous studies we have demonstrated a functional interaction between hypothalamic and mesencephalic structures (DMH-PeF, dlPAG) with several pontine regions (PBc, A5) (Díaz-Casares et al., 2009, López-González et al., 2020). 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 characterise the relationship between mesencephalic-pontine neuronal circuits to understand their role in laryngeal control and its effect on vocalization.

Methods: Experimental studies were carried out with non-inbred male rats (n=7), SPF, Sprague-Dawley (300-350 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 a precision differential pressure transducer (ADInstrument model FE141, ± 0,03 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 CnF using concentric bipolar electrodes (1 ms pulses, 20-40 μA, 100 Hz for 5 s) was performed. Respiratory flow, pleural pressure, blood pressure, heart rate and ECG activity were also recorded.

Results: CnF stimulation evoked a decrease of laryngeal resistance (subglottal pressure) ($p<0,01$) accompanied with an inspiratory facilitatory response consisted of an increase in respiratory rate ($p<0,01$), together with a pressor ($p<0,001$) and a tachycardic response ($p<0,01$).

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

Keywords

Subglottic Pressure, Laryngeal Motoneurons, cuneiform nucleus, Rat.

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