

Impact of Dorsolateral Periaqueductal Grey Matter stimulation in laryngeal activity and subglottic pressure in rats

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The stimulation of the dorsolateral Periaqueductal Gray matter (dlPAG) produces an increase in sympathetic tone that includes an increase in cardiorespiratory parameters (blood pressure, heart rate and respiratory frequency). PAG and nucleus retroambiguus (nRA) are necessary to produce vocalization. The nRA modifies the activity of laryngeal motoneurons located in the nucleus ambiguus. Rostral and ventral pontine structures involved in cardiorespiratory control, Parabrachial complex (Pbc) and A5 Region (A5) are also involved in changes of laryngeal caliber. A high expression of FOXP2 protein, a transcription factor closely related to vocalization, at the level of the PAG, Pbc and A5 has been shown. The aim of this study was to characterize the relations between mesencephalic regions (dlPAG) involved in cardiorespiratory control and their possible role in modulating laryngeal activity.

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 tracheal cannulation for the recording of respiratory airflow and subglottic pressure was carried out. Subglottic pressure was recorded with an aneroid transducer (Hugo Sachs Elektronik D-7801, $\pm 0,1$ psi) by passing a stream of humidified warm 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). Thus, at constant air flow, changes in pressure indicate changes in laryngeal resistance. Microinjections of PBS-Evans Blue (250 nl, pH 7.4 \pm 0.1, 5-s duration) or glutamate (0,25M, 250 nl) were performed within dlPAG. Respiratory flow, pleural pressure, blood pressure, heart rate and ECG activity were also recorded.

Microinjection of PBS-Evans Blue within dlPAG did not produce any significant cardiorespiratory changes. However, glutamate microinjections within the dlPAG evoked a decrease of laryngeal resistance ($p < 0,001$) accompanied with an increase in respiratory rate ($p < 0,001$) together with a pressor ($p < 0,001$) 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, dlPAG, Nucleus Ambiguus

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