

DIFFERENTIAL EFFECTS OF KAINIC ACID LESIONS IN MEDULLARY RAPHE ON COUGH AND SNEEZE IN ANESTHETIZED RABBITS

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The effects of microinjections of the excitatory neurotoxin kainic acid (2 mg/ml; 49 ± 1 nl, range 45-50 nl) on the mechanically induced tracheobronchial cough, sneeze and the solitary expulsions from the trachea were examined in 11 rabbits (6 chinchilla, 5 New Zeland white; 3.83 ± 0.13 kg) of both sexes anesthetized with sodium pentobarbital (Biowet, Pulavy; 38 mg/kg, i.p.). Blood pressure, esophageal pressure (EP) and electromyograms (EMGs) of the diaphragm (DIA) and abdominal muscles (ABD) were recorded. The micropipette with the neurotoxin dissolved in artificial cerebrospinal fluid or this vehicle only (51 ± 1 nl, range 38-60 nl, as a control) was mounted in a stereotaxic manipulator and micropositioner (David KOPF, USA) and its tip was inserted into the medulla (1.6 - 2.8 mm rostral to the obex, 1.4 - 1.6 mm and 2.9 - 3.2 mm below the dorsal medullary surface - 2 positions and 2 microinjections during the protocol). Paired t-test was employed in statistical analysis. Kainic acid microinjections reduced the number of coughs (mean \pm SE) from 3.8 ± 2.0 to 0.9 ± 0.7 ($p=0.016$), amplitudes of cough DIA from 90 ± 11 to 42 ± 13 % ($p=0.004$) and ABD EMG moving average from 103 ± 9 to 37 ± 15 % ($p=0.006$), inspiratory from 0.67 ± 0.13 to 0.36 ± 0.12 kPa ($p=0.013$) and expiratory EP from 1.70 ± 0.54 to 0.89 ± 0.46 kPa ($p=0.008$). Kainic acid microinjections had no effect on the number of sneeze reflexes, nevertheless, they lowered amplitudes of ABD EMG moving average from 81 ± 9 % to 55 ± 13 % ($p=0.027$) and expiratory EP during sneeze from 92 ± 7 % to 55 ± 7 % ($p=0.003$). No significant effects of raphé lesions were found on solitary expulsions induced (together with tracheobronchial coughing) from the trachea. These effects were accompanied by a significant increases in mean systemic blood pressure from 10.76 ± 0.9 to 12.03 ± 0.8 kPa ($p=0.003$) as well as in respiratory rate from 19.3 ± 2 to 23.9 ± 2 kPa ($p=0.01$). Complex spatiotemporal analysis of cough and sneeze revealed significant increases in the duration of cough active expiratory phase from 249 ± 38 to 350 ± 51 ms ($p=0.045$), intervals between maxima of DIA and ABD EMG discharges from 108 ± 11 to 183 ± 36 ms ($p=0.045$) as well as in active portion of total cough phase duration from 545 ± 63 to 772 ± 41 ms ($p=0.042$). Other temporal parameters of cough and sneeze such as the inspiratory, all expiratory, total cycle durations and periods of relative motor quiescence between reflexes within the trial were not altered significantly. Our findings suggest a diverse role of raphé neurons in central control of different motor responses from the airways particularly cough and sneeze. A complex function of raphé neurons in the generation of the cough motor pattern is suggested as well.

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