

Temporal neuronal relationships in dorso-medial medulla of rats under a pain influence

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The purpose was to study the characteristics of temporal neuronal relationships in dorso-medial medulla of rats under mechanical nociceptive stimuli influence.

The experiments were conducted on 11 anesthetized rats (males, weight 330-360g, 6-7 months of age). The multiunit records in dorso-medial part of medulla (nuclei of the solitary tract) were implemented before and during the pinch influence on hind pad of animals. A post-experimental histologic control of microelectrode location site was made. The separate neuron spikes were found and sorted out. The cross-correlograms (interval 0.06s, bin 0.001s) were used in order to reveal the temporal neuronal relationships. The histogram maximums and minimums which exceeded the average value of histogram bin amplitude on two standard deviations were taken as criteria of temporal neuronal relationships.

The activity of 24 neurons (15 neuronal pairs) was recorded. Thirty two and forty two significant histogram peaks and minimums were detected in temporal interval 0-20ms relatively of histogram centers before and during the pain influence, respectively ($p < 0.05$).

Seven ($21.9 \pm 7.3\%$) and nine ($21.4 \pm 6.3\%$) neural relationships were observed in 6 ($54.5 \pm 15.7\%$) and 8 ($72.7 \pm 14.0\%$) neuronal groups and had the significant histogram peaks in temporal interval 3-9ms (before and during the pain influence, respectively).

Three ($9.4 \pm 5.1\%$) neural relationships had the significant histogram peaks in temporal interval 0-2ms and were observed in 3 ($27.3 \pm 14.0\%$) neuronal groups before the pain influence. Such relationships were not observed under the pain influence.

One neural relationship ($3.1 \pm 3.0\%$) with significant histogram minimum in temporal interval 3-9ms was detected in 1 ($9.1 \pm 9.1\%$) neuronal group before the pain influence. Such kind of relationships was not detected during the pain influence.

Twelve ($37.5 \pm 8.5\%$) and nineteen ($45.0 \pm 7.7\%$) neural relationships were detected in 7 ($63.6 \pm 15.2\%$) and 11 (100.0%) neuronal groups and had the significant histogram minimums in temporal interval 0-2 ms (before and under the pain influence, respectively, $p < 0.05$).

Nine ($28.1 \pm 7.9\%$) and fourteen ($33.3 \pm 7.3\%$) relationships were revealed in 6 ($54.4 \pm 15.7\%$) and 7 ($63.6 \pm 15.2\%$) neuronal groups and had the waves with significant histogram peaks in temporal interval 10-20ms (before and under pain influence, respectively).

So, the total amount of neural relationships in dorso-medial medulla was greatly enhanced during the pain influence. A number of ultra-fast and fast excitatory relationships was decreased whereas a number of ultra-fast inhibitory and delayed excitatory relationships was significant increased. The different neuromodulator mechanisms can be responsible for such changes by shifting the membrane potentials of medullar neurons.

Thus, the temporal neural interaction in dorso-medial medulla of rats undergo a marked functional reorganization under the pain stimuli influence with more strong prevalence of ultra-fast inhibitory and delayed excitatory relationships.

References

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