

Poster presentation

## Changes in learning and memory after single and simultaneous lesion of the serotonergic and noradrenergic systems in the rat

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### Background

Noradrenergic (NA) and serotonergic (5-HT) pathways play an inevitable role in several crucial central nervous system functions such as learning and memory, sleep, food-consumption and mood. Slight changes in the state of equilibrium of these neurotransmitters can lead to the development of severe psychiatric states. Dysfunction of these systems may be responsible for the considerable deficits of memory and learning processes occurring in mood and anxiety disorders. Nevertheless the exact mechanism by which these monoamines influence these processes are not yet fully understood. The way of interaction of these two systems between each other and with other neurotransmitters and neuromodulators is still an interesting field of CNS-research.

The aim of present study was to evaluate the impact of single and combined lesions of the NA- and 5-HT systems on memory and learning functions of the rat.

### Materials and methods

Serotonergic and noradrenergic pathways of male Sprague-Dawley rats were chemically lesioned by intracerebroventricular administration of selective neurotoxins 5,7-dihydroxytryptamine (5,7-DHT) and N-(2-chloroethyl)-N-ethyl-2-bromobenzylamine-HCl (DSP-4) respectively. To determine the extent of lesions, HPLC-EC method was used to measure 5-HT and NA levels extracted from the hippocampal tissue of the animals.

To evaluate the effects of different types of lesions on learning and memory, after 2 weeks of recovery, long term potentiation (LTP) test in vitro and passive avoidance test in vivo were performed on intact, sham-operated, NA-, 5-

HT-, and double (NA+5-HT)-lesioned animals. LTP was measured in CA1 region of the hippocampal slices of lesioned animals.

### Results

In vitro NA-depletion induced significant increase in synaptic transmission as revealed by measurement of hippocampal PS-LTP in the CA1-region. In the passive avoidance test in vivo selective lesion of 5-HT-pathways resulted in significant decrease of step-in latency on the 2nd day indicating memory deficit. Selective lesion of NA- pathways had no effect on retention. Combined lesion of these two systems caused slight decrease in retention, however this decline did not reach the level of the effect induced by lesion of 5-HT pathways.

### Discussion

Our results indicate that lesion of NA-system has procognitive effect in vitro. 5-HT-deficit produces considerable memory-impairment in vivo. Production of LTP and normal performance in the passive avoidance test which are adequate indicators of learning and memory functions require functional integrity of 5-HT- and NA transmitter systems. This idea is supported by the finding that combined lesion of these two systems ameliorated the memory-declining effect of the selective 5-HT lesion. The communication of NA- and 5-HT-erg pathways may occur via a common mediator in these CNS-functions, however this theory requires further investigation.