Effect of scopolamine on hidden- and visible-water maze learning and retention trial performance in C57BL mice

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The Morris water maze is one of the most extensively used tools in behavioral neuroscience to investigate spatial learning and memory [1]. MWM learning is thought to rely extensively on hippocampus, and involves several major neurotranmitter systems. One such major neurotransmitter system of great importance is the cholinergic system [2]. Scopolamine, a muscarinic cholinergic antagonist, is known to cause impairments in MWM testing [1]. Studies have suggested that scopolamine administration specifically impairs the development of spatial navigation strategies, thus the acquisition, rather than memory consolidation or recall [2,5]. Day and Schallert hypothesized that acquisition impairment, following anticholinergic treatmentis mediated at least partially by entrapment in an inefficient, non-place strategies [3]. The present study investigates the effect of scopolamine in MWM. Subjects were trained during 10 trialblocks, each of which consisted out of 4 trials. After the fifth and the tenth training trial, animals were tested (probe trial of 100s). Animals (n=4) were injected with scopolamine (1mg/kg), 30 minutes prior to performance. Animals (n=4) injected with saline (10ml/kg) served as controls. To examine whether the impairment is due to deficits in acquisition or recall, we injected control animals (n=2) with scopolamine (1mg/kg) 30 minutes before the second probe trial. In another trialblock all animals (n=8) received saline injections (10ml/kg).

Scopolamine injection during acquisition affected MWM learning as well as retention trial performance (see figure 1) (effect of treatment: p<.001; effect of trialblock: p<.001; interaction: p=.07). Considering the learning curve, the impairment of scopolamine treated animals seemed most pronounced in the first week of training, after which constancy is reached within both groups. On both probe trials, we do not find significant differences between scopolamine treated animals and controls (Probe 1: effect of treatment: p=.172; effect of quadrant: p<.001, interaction: p=.003; Probe 2: effect of treatment: p=1.000, effect of quadrant: p=.08, interaction: p=.813).

Control animals that received scopolamine before the second probe trial did not perform differently from saline-treated animals (p=.514) (see Figure 2). We conclude that scopolamine affected acquisition performance but not performance on probe trials. It could be argued that indirect effects of scopolamine could underlie the effects of this drug (e.g.,hyperactivity, resulting from scopolamine administration, can make it more difficult for the animals to stay on the platform). In a final experiment, we assessed the effects of scopolamine treatment on visible-platform MWM performance. No difference in latency between scopolamine-treated animals and controls was found in the visible-platform condition (p =.486), which suggests that motivation, nor locomotor hyperactivity underly the differences found during MWM acquisition in laboratory mice. Thus, the present findings indicate that scopolamine affects central brain mechanisms underlying spatial learning, possibly in relation to previously reported impairment of inhibitory avoidance behavior following disturbed amygdaloid cholinergic functions [5].

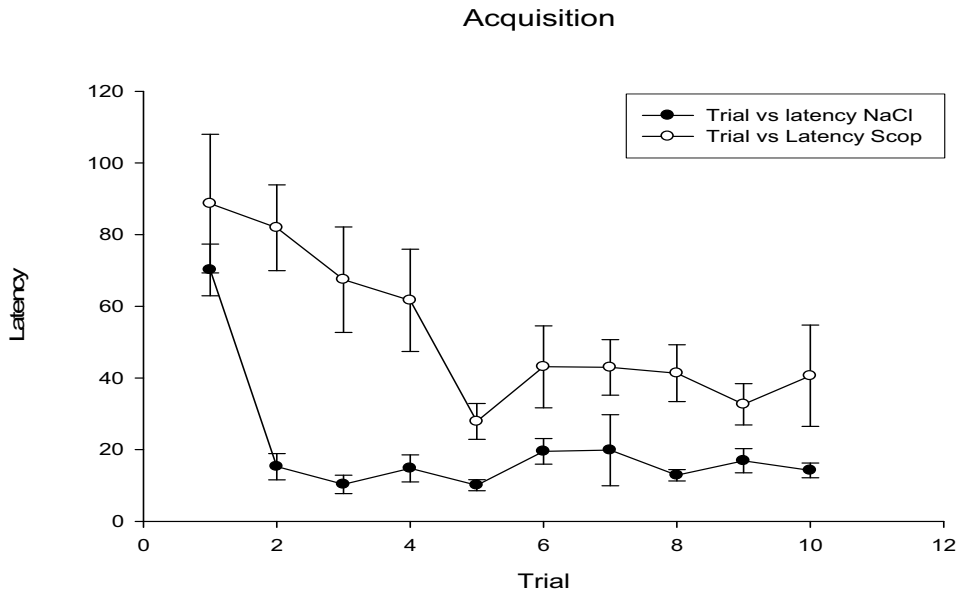

Figure 1. *The effect of scopolamine on the acquisition of the Morris water maze.*

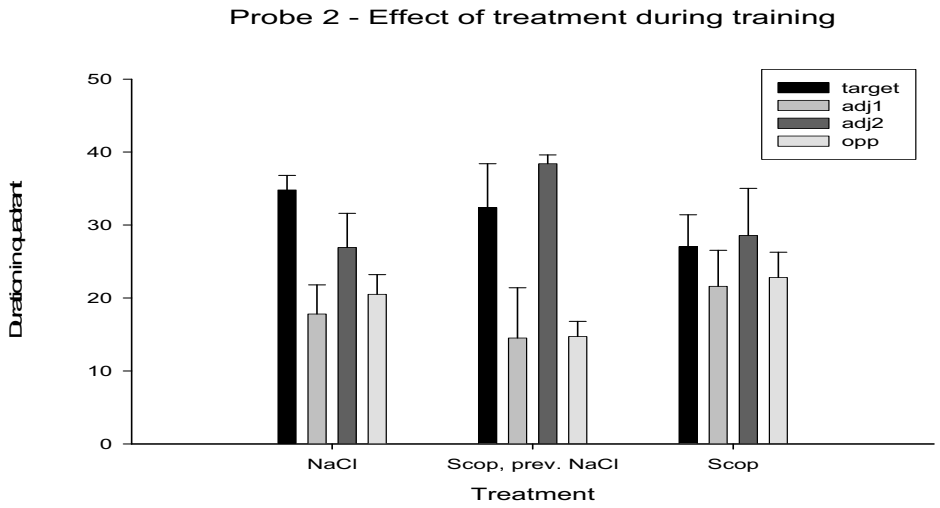

***Figure 2**. Effect of previous treatment during the second probe trial.*

References

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