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Effects of different anesthetics on hippocampal and reticulo-thalamic gabaergic parvalbumin-expressing interneurons

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We examined the effects of ketamine/diazepam and propofol anesthesia on hippocampal and reticulo-thalamic (RT) GABAergic parvalbumin (PV)-expressing interneurons in the rat.

A total of 20 adult male Wistar rats were divided into two experimental groups - half were anesthetized with ketamine/diazepam (100 mg/kg, Zoletil® 50), and the other half received propofol anesthesia (100 mg/kg; Propofol Lipuro 2% (20mg/ml). We performed immunohistochemistry protocols for PV and postsynaptic density protein 95 (PSD-95) staining on free-floating 40- μ m brain slices. We used PSD-95 as an excitatory synaptic marker to test local excitation changes along with changes in PV expression.

Our results show significant suppression of GABAergic PV-expressing interneurons during ketamine/diazepam anesthesia compared with propofol anesthesia, in the dentate gyrus and CA3 regions of the hippocampus ($z \geq -4.16$, $p \leq 10^{-3}$), and in the RT. Moreover, this suppression resulted in an increase in PSD-95 expression only in the hippocampus of rats anesthetized with ketamine/diazepam. Topographically distinct effects of propofol anesthesia were not detected.

The observed imbalance between excitation and inhibition at the level of the hippocampus during ketamine/diazepam anesthesia could be a consequence of lower interneuronal GABA activity. Conversely, the topographically uniform expression of PSD-95 during propofol anesthesia together with higher expression of GABAergic interneurons could possibly indicate a stronger effect of GABA-mediated inhibition in the hippocampus compared with ketamine/diazepam anesthesia.

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