The effect of melatonin in epileptogenic and neurodegenerative effects induced by palytoxin in rats

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Palytoxin (PLTX) is a marine polyether toxin with a very large and complex molecule released by PLTX-producing Ostreopsis cf. ovate usually associated to human respiratory and cutaneous problems. At the molecular level, PLTX induces a massive intracellular Na^+ influx due to the transformation of Na^+/K^+ ATPase in a cationic channel, thereby affecting also H^+ and Ca^{2+} ions balance.
Here we investigated on the central effect of PLTX infused into the lateral ventricle of rat brain mainly on the induction of epileptogenic and neurodegenerative effects.
Administration of PTLX elicited in all of the treated animals (n=6) motor seizures and electrocortical (ECoG) discharges after a latent period of approximately 5 min. At 24 h, histological examination of brain (n=6) coronal sections detected damage both in lateral ventricle and in the hippocampal area.
Quantitation of damage revealed a significant neuronal cell loss in the CA1 and CA4 pyramidal cell layer and in dentate gyrus granule cell layer as compared to the corresponding brain regions of rats (n=6) injected with bovine serum albumin (300 ng), which per se was ineffective in all respects. PLTX also caused a significant loss of CA3 pyramidal neurons to the site of toxin injection.
Systemic (i.p.) administration of melatonin delayed the onset of motor and ECoG seizures and reduced the number of epileptogenic discharges typically observed in rats receiving an injection of palytoxin alone.
Similarly, this treatment prevented the brain tissue damage in lateral ventricle and within the hippocampus which followed central infusion of PLTX, thus showing that melatonin receptors may be involved in the neurotoxic effect of PLTX.
In conclusion, the present data support a role for free oxygen radical species in mediating lateral ventricle and hippocampal damage induced by PLTX thus representing a complementary neurobiological tool to study mechanisms of seizures and neuronal death.