Exposure to uncontrollable stimulation during pentobarbital anesthesia has a long – term disruptive effect on spinal cord function

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Behavioral potential (plasticity) within the spinal cord can be assessed using an instrumental learning paradigm. (Grau et al., 1998, Behav Neurosci, 112, 1366). In this paradigm, rats are transected at the second thoracic vertebra (T2) and given shock to one hindlimb whenever the leg is extended (controllable shock). Over time, these subjects exhibit an increase in flexion duration that reduces net shock exposure. Rats that receive an equal amount of shock independent of leg position (uncontrollable shock) fail to exhibit an increase in flexion duration. Furthermore, rats given uncontrollable shock also fail to learn when later tested with controllable shock applied to either the same or opposite leg. This behavioral deficit can be induced by just 6 min of uncontrollable shock to the leg or tail and lasts up to 48 hrs. Subjects exposed to uncontrollable shock prior to spinal transection do not exhibit a behavioral deficit, suggesting that descending supraspinal systems protect the spinal cord from the deleterious effects of uncontrollable shock. This protective effect is removed by manipulations that disrupt serotonergic fibers that descend through the dorsolateral funiculus (DLF). The present study examines whether inhibiting brain function through surgical anesthesia disrupts the brain–dependent protection of spinal cord systems. Intact rats received pentobarbital (50 mg/kg) or saline (i.p.). Fifteen mins later, after pentobarbital–treated rats reached a stable plane of deep anesthesia, half the subjects (n=6) in each condition received 6 mins of intermittent, uncontrollable, tailshock. Twenty–four hrs later all subjects were transected at T2 and allowed to recover for 24 hrs. Rats were then tested for instrumental learning. Only animals that received pentobarbital prior to uncontrollable shock displayed a behavioral deficit.

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