Lower concentrations of isoflurane cause cognitive impairment in mice

Isoflurane is one of the most commonly used anesthetic agents in veterinary practice. Results from this study show that animals undergoing anaesthesia with isoflurane have difficulties in memorizing a new spatial task when the concentration of the agent corresponds to 1%. This situation does not occur when the concentration is increased to 1.5% and 2%.

Anaesthesia is a fundamental component of surgery procedures for both humans and animals. When undergoing surgery, a patient is made unconscious, unaware, insensate and amnesic for the duration of the surgery and briefly thereafter[1]

Despite the large body of knowledge on the direct effect of different anesthetic agents in the induction of the amnesic state, there is a rather uncertain awareness of the subtle consequences they might have on the cognitive capacity.

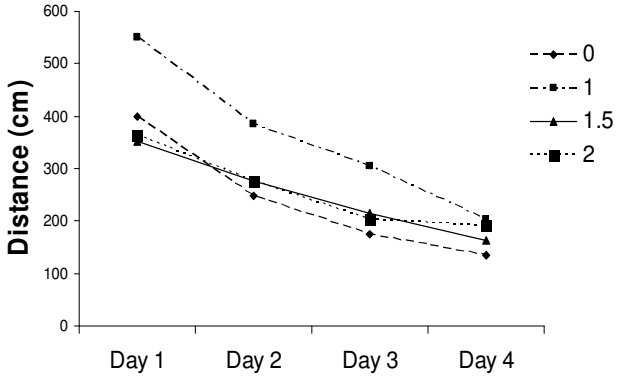

Figure 1. Mean weekly distance travelled by the four treatment groups before reaching the escape platform. Individuals treated with 1% isoflurane travelled more than the other groups (p=0.010, p=0.023, p=0.038 when compared with 0%, 1.5% and 2% respectively).

In clinical studies safety has been historically prioritized over a comprehensive understanding of the mechanism by which diverse inhalational agents result in the state of general anesthesia[2]. Today, the scientific interest has shifted towards the specificity of the mechanism through which anesthesia is induced, which is currently giving a more powerful insight on the basis of consciousness from molecular, to anatomic to behavioural level.

Few studies have recently aimed at identifying the memory effects of anesthesia with isoflurane and they revealed long-lasting impairment in aged rats and an unexpected improvement in young individuals[3]. In order to assess whether cognitive impairment would be directly related to the concentration of anesthetic agent used, 4 different treatment groups of mice where compared, each defined by a distinguished concentration of isoflurane (0%, 1%, 1.5%, 2%). They were tested in a spatial task (Morris water maze) for 8 weeks, following one-hour anaesthesia.

As shown in figure 1, the animals treated with a lower concentration of

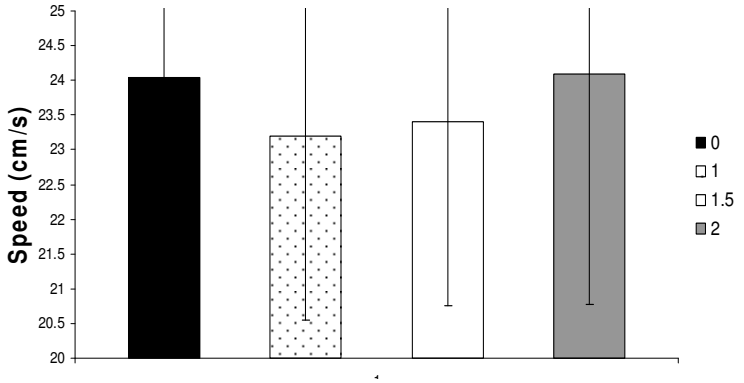

Figure 2. Average swim speed at which the 4 treatment groups travelled within the maze.

isoflurane (1%) performed more poorly, as it is demonstrated by observing that on average they required to travel a longer distance in order to finish the memory task. Overall, all the individuals travelled at similar speeds, which is a good indicator of the absence of locomotory impairment (see figure 2). These results are important when considering that behavioural studies would be drastically affected by the cognitive impairment caused by isoflurane, hence, selecting for higher concentrations, would be more recommendable than a lighter anaesthetic procedure. Furthermore, when considering the welfare status of the animals being tested, we should make these considerations as they would help avoiding unnecessary learning impairment. Overall, the individuals travelled at similar speeds, which is a good indicator of the absence of locomotory impairment.

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