EFFECTS OF VANADIUM IN THE CNS AT DIFFERENT TIME POINTS POST EXPOSURE

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Introduction

Epidemiological data suggests that environmental vanadium has a direct impact on health and could be implicated in the aetiopathogenesis of neurodegenerative diseases, but time and dose–response relationships with Central Nervous System (CNS) disorders are largely unknown. Tyrosine Hydroxylase (TH) and Myelin Basic Protein (MBP) are proteins involved in several physiological processes of the CNS [1, 2]. The aim of this study was to determine the effects of different doses of vanadium in the CNS at different time-points, by assessing TH and MBP expression.

Materials and Methods

Forty two adult *Wistar* rats were used in this study, divided in six groups. Four groups were exposed to a solution of vanadium pentoxide (V_2O_5) by intranasal delivery three times a week for 4 weeks, each two groups were exposed to V_2O_5 at a concentration of 273 µg and 182 µg, respectively, in 30 µL of distilled water, and two control groups. Individuals from one 273 µg and 182 µg concentration group and one control were sacrificed after 4 weeks of exposure, the remaining two concentration and control groups four weeks after the last V_2O_5 administration. Full necropsy was performed, and brains processed for routine paraffin histopathological evaluation. All experiments were approved by the Portuguese Agency for Animal Welfare (general board of Veterinary Medicine in compliance with the Institutional Guidelines and the European Convention).

Results

Vanadium exposure resulted in gliosis and neuronal death, particularly in the olfactory bulb and hippocampus (Figure 1). TH expression in the olfactory bulb was decreased immediately and four weeks after exposure (Figures 2-4). The intensity of MBP expression and the extent of its stained area was not affected (Figures 5-6), however, there was a change in the expression patterns of this protein in the olfactory bulb of animals exposed to the highest concentration of V_2O_5, being more scattered and irregular, particularly in the olfactory bulb (Figure 5).

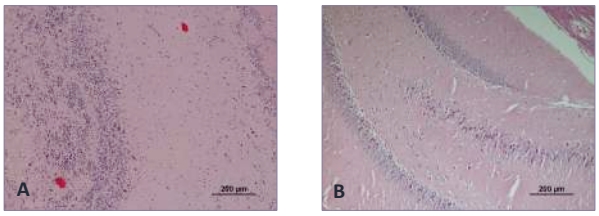

Fig. 1 Hematoxylin-Eosin-Stained A) Olfactory bulb, B) Hippocampus 24 hours after the last administration.

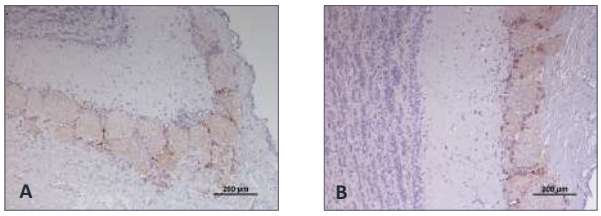

Fig. 2. TH positive neurons observed in the olfactory bulb of control group: A) 24 hours, and B) 4 weeks after the last administration.

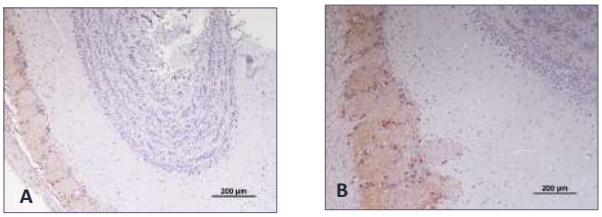

Fig. 3. TH positive neurons observed in the olfactory bulb of rats exposed to 182 µg of V_2O_5 sacrificed: A) 24h after, and B) 4 weeks after the last administration.

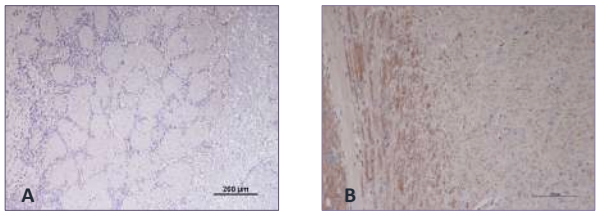

Fig. 4. TH positive neurons observed in the olfactory bulb of rats exposed to 273 µg of V_2O_5 sacrificed: A) 24h after, and B) 4 weeks after the last administration.

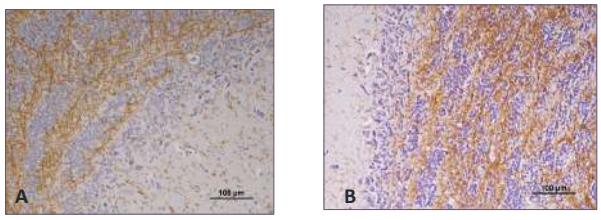

Fig. 5. MBP Immunostaining in the olfactory bulbs of the: A) control group 4 weeks after the last administration; B) group exposed to 273 µg of V_2O_5 24h after the last administration.

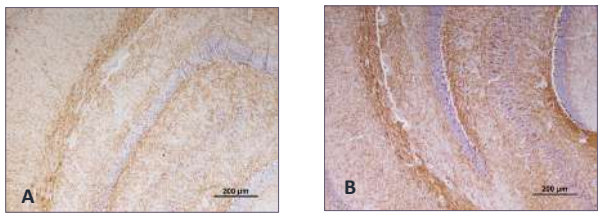

Fig. 6. MBP Immunostaining in the hippocampus of the: A) control group 4 weeks after the last administration; B) group exposed to 273 µg of V_2O_5 24h after the last administration.

References

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Conclusions

Vanadium has a negative impact in the CNS and its effects persist four weeks after exposure. Further studies are required to clarify the MPB expression changes observed.

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