The Comparison of Quaternary and Non-quaternary Reactivators Effectiveness

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Introduction

Nowadays, the inhibitors of acetylcholinesterase (AChE) are known mainly as the nerve paralytic agents (NPA), which are used as chemical weapons in Asian countries. The best-known chemical weapons are Sarin, Tabun, Soman and VX. When the NPA penetrates the body, accumulation of AChE occurs in areas of nerve synapses and neuromuscular termination. Intoxicated people experience symtoms such as salivation, sweating, blurred vision etc. If these poisons are not detected in time and treatment is not initiated, NPA inhibit the respiratory center, which can lead to death. [2]

One possible treatment is represented by reactivators. Standard use are quaternary reactivators (with quaternary nitrogens), fx pralidoxime, HI-6 and obidoxim. However, there is no universal reactivator that could be used against all known NPA. For these reason, non-quaternary reactivators (without quaternary nitrogen) began to be developped and tested. [2]

The main goal of the thesis is the comparison of quaternary (pralidoxime) and non-quaternary (K1280) reactivators effectiveness when Sarin is applied.

Research Methods

In the practical part I measured the AChE activity in the mouse blood, brains and diaphragms. The mice were divided into four groups according to the applied substance. In each group were six mice.

Table 1 Measured groups

	MOUSE
Group 1	Physiological saline + atropine (10 mg/kg)
Group 2	Sarin (1 LD_{50} = 135 µg/kg) + atropine (10 mg/kg)
Group 3	Sarin (1 LD_{50} = 135 µg/kg) + atropine (10 mg/kg) + pralidoxime chlorid (85 mg/kg)
Group 4	Sarin (1 LD_{50} = 135 µg/kg) + atropine (10 mg/kg) + K1280 (100 mg/kg)

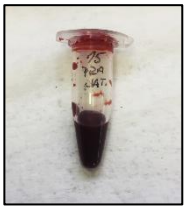

Figure 1 Blood

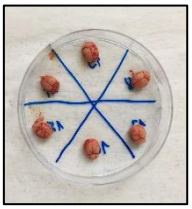

Figure 2 Brains

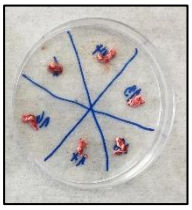

Figure 3 Diaphragms

Results

Subsequently, I draw up the charts demonstrating AChE activity in the mouse blood, brains (Chart 1) and diaphragms.

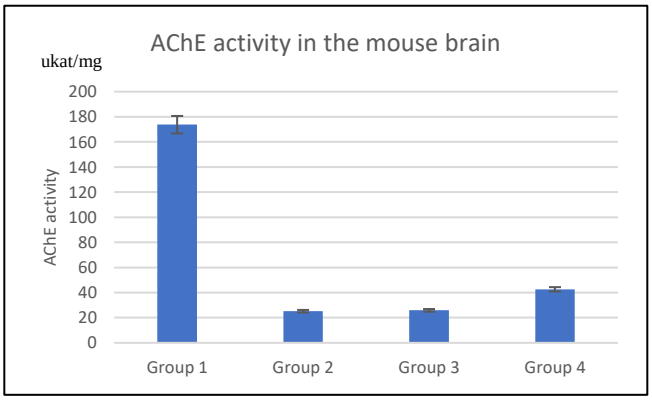

Chart 1 AChE activity in the mouse brain

Based on measured results, it was found out that the new tested substance K1280 (as non-quater. react.) in the blood and brain reactivate AChE activity better than quater. react. pralidoxime. However, K1280 in the diaphragm testing didn‘t reach better results than the standard use pralidoxime.

Therefore, in this project it wasn‘t possible to determine whether the quater. or non-quater. react. is more efficient.

Conclusion

Thanks to positive results from AChE activity measurements in blood and brain, the concept of non-quaternary reactivators seems to be a good way.

In the future, it would be good to carry out another thesis, based on *in vivo* testing of newly synthesized non-quaternary reactivators, which can conduce to development the universal reactivator capable of reactivating activity AChE inhibited by all known NPA.

Literature

[1] ŠIMKOVÁ, Markéta. *Srovnání účinnosti kvarterního a nekvarterního reaktivátoru*. První soukromé jazykové gymn. Hradec Králové, 2018.

[2] SOUKUP O., JUN D. , KUČA K. a kol. *An in vitro evaluation of non-quaternary reactivators of AChE as antidotes of organophosphorus poisoning*. 2017.