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The Psychophysiological Effects of the Chemical Terrorist Attacks – the Neurotoxic Agent: Sarin

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Abstract:

Sarin (GB, O-Isopropyl methylphosphonofluoridate) is an organophosphate neurotoxic agent that inhibits irreversibly acetylcholinesterase (AChE). Next, the accumulation of acetylcholine (ACh) in the central nervous system (CNS) causes convulsions and, in high dosage, centrally mediated respiratory failure. The ACh accumulation at peripheral vegetative synapses level leads to peripheral signs of intoxication and overstimulation of muscarinic and nicotinic receptors, which is described as "cholinergic crisis" (diarrhea, perspiration, salivation, miosis, bronchospasm). The exposure to high dosage of Sarin may lead to tremor, convulsions and hypothermia. More seriously, the accumulation of ACh at neuromuscular junctions' level may also cause paralysis and peripherally mediated respiratory failure that can lead to death by breathing arrest.

In addition to the main action on the cholinergic system, Sarin has other secondary effects. These involve activating some neurotransmitters including the gamma-amino-butyric acid (GABA) and alteration of other cellular signaling systems, such as the ionic channels, cellular adhesion molecules and inflammation regulators. The Sarin exposure is associated with symptoms of late neurotoxicity induced by organophosphates and chronic neurotoxicity induced by organophosphates. Moreover, Sarin has been involved in the toxic and immunotoxic effects such as endocrine disorders induced by organophosphates.

The standard treatment for exposure to the Sarin neurotoxin is a post-exposure injection with atropine, an antagonist of muscarinic receptors, followed by oxime, an AChE reactivator, and diazepam.

Keywords:

Neurotoxicity, Organophosphates, Sarin, Toxicity, Oxime, AChE, BChE, LD 50