LONG-TERM EXPOSURE TO PESTICIDES AND NEUROPSYCHOLOGICAL SYMPTOMS IN A TEENAGE MALE: A CASE REPORT

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ABSTRACT

We report a case of a 15-year-old teenage male who was chronically exposed to pesticides and presented neurological and psychic symptoms. He presented muscle cramps frequently, loss of muscle strength on right side of the body, parosmia in both nostrils, deep reflexes changes, sleep disorders and psychic symptoms, such as moderate anxiety. Those symptoms could be associated with his chronic management of pesticides which is supported by epidemiologic studies that implicate exposure to pesticides in the etiology of neurological and psychological impairments. Thus, we highlight the importance of health monitoring of individuals exposed to pesticides, because this exposure may raise the risk of neurological disorders, including neurodegenerative diseases.

Keywords: Pesticide; Occupational exposure; Neurologic manifestations; Mental disorders.

EXPOSIÇÃO CRÔNICA A PESTICIDAS E SINTOMAS NEUROPSICOLÓGICOS EM UM ADOLESCENTE: UM RELATO DE CASO

RESUMO

Nós relatamos o caso de um adolescente de 15 anos de idade exposto cronicamente a agrotóxicos que apresentou sintomas neurológicos e psíquicos. Ele apresentava câimbras musculares frequentes, perda da força muscular no lado direito do corpo, parosmia em ambas as narinas, alterações de alguns reflexos profundos, distúrbios do sono e sintomas psíquicos, como ansiedade moderada. Nós consideramos que esses sintomas podem estar associados com o manejo crônico de agrotóxicos. Nossas observações corroboram estudos epidemiológicos que mostram que a exposição a agrotóxicos pode causar distúrbios neurológicos e psicológicos. Assim, nós enfatizamos a importância da monitorização da saúde de indivíduos expostos a agrotóxicos, uma vez que essa exposição pode aumentar o risco de doenças neurológicas, incluindo doenças neurodegenerativas.

Palavras-chave: Agrotóxico; Exposição ocupacional; Manifestações neurológicas; Transtornos mentais.

INTRODUCTION

Pesticides are substances intended to control or kill pests such as insects, rodents, fungi and weeds[1,2]. According to chemical structure, pesticides can be grouped into four main groups namely: organochlorines, organophosphorus, carbamates and pyrethroids. Ideally, pesticides should be specific to the target organisms, however, the occurrence of toxicity against non-target organisms is common and it is a substantial concern around the world[3].

Exposure to pesticides can be extremely hazardous to human health. The Central Nervous System (CNS) is a system particularly susceptible to pesticides effects, especially

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because of its intrinsic mechanisms of metabolism and biomolecular transport[4]. The neurotoxicity of pesticides has been associated with acute and chronic neurological manifestations[5]. Evidence suggests that exposure to pesticides increases the risk of developing neurodegenerative diseases, such as Parkinson's disease (PD)[6].

Agricultural workers have an increased risk to present neurological symptoms due to the high occupational exposure to these compounds associated with inappropriate use of personal protective equipment[7-9]. Moreover, there is a high prevalence of PD and other neurodegenerative diseases, such as Alzheimer's disease and Amyotrophic Lateral Sclerosis, in residents of rural communities, where exposure to pesticides is greater[10,11].

In this report, we describe a case of a 15-year-old teenager rural worker who had neurological alterations and psychic symptoms. Our findings demonstrate the occurrence of characteristic signs and symptoms of nervous system dysfunction, probably associated to pesticide exposure.

CASE REPORT

During a study investigating the relationship between pesticide exposure and changes in the CNS, we found the case of a 15-year-old boy farmer directly exposed to pesticides who had neurological and psychic symptoms. He lives in a rural community in the state of Sergipe, Brazil, and works on agriculture with his parents. Through an interview, we collected his anamnesis and aspects related to the use of agrochemicals. Afterwards, a neuro-psychological examination was performed.

The teenager stated that he had started manipulating pesticides since he was 5-year-old, with a high frequency. The glyphosate, an organophosphate herbicide, was the most frequently used pesticide by his family. He had no history of poisoning by these products, no comorbidities and he was not taking any drugs at the time. In the interview, he complained of frequent muscular cramps in both lower limbs.

The cranial nerve examination revealed normality in the visual field, ocular motricity, facial sensitivity and motricity. No nystagmus was found during the examination. We assessed his sense of smell using three substances with well-known odors: cinnamon, coffee and cumin. With eyes closed, he had to identify the aroma exposed by the examinator. The examination revealed parosmia in both nostrils when exposed to these substances. He stated that had never smoked and denied any history of upper respiratory tract infections, allergies or known nose and sinus disorders.

A muscular strength test, graded from zero (no movement) to five (normal strength), revealed grade 4 (moderate strength against resistance applied by the examiner) only on the right-side when performing wrist extension, knee extension and ankle dorsiflexion. The muscle tone in both upper and lower limbs, on both sides, were normal. We noted a hyporeflexia of the tricipital, patellar and Aquilles deep tendon reflexes on the right and left side of the body. The tactile and thermal sensitivity were normal. Pain sensitivity test was performed stimulating the skin with the extremity sharp of a pin, and showed a reduction in pain sensitivity in both upper limbs and the anterior trunk. He showed an impaired motor coordination in the finger-to-nose test, especially when sensitized (eyes closed). The Romberg test was negative.

Finally, we interviewed him in detail on his mental status, using the following scales: Mini Mental State Examination (MMSE); Self-Report Questionnaire (SRQ); Hamilton Depression Rating Scale (HRDS); and State-Trait Anxiety Inventory (STAI), composed of two scales, which intend to measure state (STAI-S) or trait (STAI-T) anxiety components. The MMSE showed a score of 26, considered within the normal range according to his academic level. His SRQ score was 10, revealing a state of mental suffering. His main complaints were poor sleep quality, difficulty to think clearly and persistent tiredness. The HRDS was also within the normal range with a score of 7. Results indicated a moderate anxiety in STAI-T (score: 54) and a mild anxiety in the STAI-S (score: 35).

DISCUSSION

Given the growing evidence linking pesticide exposure to neuro-psychological symptoms[12, 4, 7, 13], we herein report the case of a teenager who has been exposed to pesticide since his childhood and presents symptoms of nervous system impairment. The characteristics of our case were both neurological and psychological symptoms, including muscular cramps, dysfunctions in olfactory and painful sensitivity, loss of muscle strength, deep reflexes changes, and a state of a mental suffering. We hypothesized that it is because of the long-term exposure to glyphosate, the most used pesticide by our case, once that this product is associated with neurological effects[14,15].

The human sense of smell decreases with age and has been recognized as a public health problem, affecting older adults overall[16]. However, here we report the case of a teenager with specific alterations of the smell. As we excluded the presence of pathologies that could affect his sense of smell, our findings suggest the possibility of glyphosate-induced

olfactory impairment, because decreases in olfactory sensibility are more commonly found after chronic exposures to pesticides[17]. High exposure to pesticides can have acute neurotoxic effects, as occupational intoxications, and may have neurological effects years later, with impairment of some cognitive, motor and sensitive functions[18].

Exposure to agrochemicals also be associated with coordination and motor functions changes, including hand tremor and reduced motor response; these characteristics are more prevalent in those directly exposed to pesticides[19]. Indeed, we found that motor coordination and muscular strength were altered, as well as the deep tendon reflexes. However, the changes on deep reflexes need to be carefully analyzed, because it is possible the participant interference in the examination. Despite this, our findings suggest the toxic action on peripheral and central neurons by chronic exposure to organophosphates, resulting in sensory and motor symptoms.

The deleterious health effects of pesticides may also include a variety of neuropsychiatric problems, like sleep wake disorders, one of the symptoms reported by our case. Long-term exposure to high cumulative levels of pesticides was associated with poor sleep quality in a previous study among greenhouse vegetable farmers in the northern region of China[20]. Experimental study reported the interference of these compounds on the regulation of serotonin and other neurotransmitters, through which the agrochemicals induce mental disorders[21, 22]. Possible reasons for this sleep disturbance in the present case may be associated to his psychic symptoms. Evidence suggests that exposure to pesticides is related to mental disorders, especially in occupationally exposed populations, such as farmers with more than twenty years of work in the agriculture[23]. Our case was only 15-years-old at the moment of analysis, but he already had complaints such as difficulty to think clearly, difficulty to take decisions and frequent crying episodes, which according to the scores represents psychological distress, probably due to long-term exposure to pesticides.

One of the limitations of this case report is that it was not evaluated by specialists in order to make the possible diagnosis of neurological and psychiatric conditions. Thus, here we report only the findings from anamnesis and physical examination. However, these findings support the association between long-term pesticide exposure and dysfunctions of the CNS. Further studies are needed to clarify about the phenomena presented here, allowing the development and improvement of health public politics for the safety of these individuals.

CONCLUSIONS

In conclusion, the case discussed herein suggests that chronic exposure to pesticides represents a risk for the occurrence of disturbances of the CNS. The occurrence of olfactory dysfunction draws out attention once it is prodromal signal of neurodegenerative diseases such as Parkinson's Disease. Our results indicate the importance of health monitoring of individuals exposed to pesticides because this exposure has been associated with an increased risk of developing health problems, like neurological and psychic disorders.

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