

# Chronic organophosphate-induced neuropsychiatric disorder: a case report

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**Abstract:** Chronic organophosphate (OP)-induced neuropsychiatric disorder is a rare condition following prolonged exposure to OP compounds. Due to the lack of valid diagnostic tools and criteria, very few cases are seen in clinical practice and are often misdiagnosed. Misdiagnosis can lead to inappropriate treatment that may increase the risk of morbidity or suicidality. In this paper, we present the case of a 35-year-old male who needed support in breathing from a mechanical ventilator and developed neuropsychiatric behavioral problems following ingestion of OP compounds, which lead to suicidality. The patient was treated by the psychiatric team with antipsychotic and antidepressants and improved following the regular use of medication.

**Keywords:** COPIND, mood liability, suicidal thoughts

## Introduction

As a country where agriculture is predominant, Nepal uses a lot of organophosphate (OP) pesticides as they are commonly available. OP pesticide poisoning is a leading cause of morbidity and premature loss of life in many developing countries, including Nepal.<sup>1</sup>

Chronic OP-induced neuropsychiatric disorder (COPIND) is a condition characterized by a prolonged exposure to OP pesticides (with or without acute cholinergic episodes) and the development of various neuropsychiatric symptoms.<sup>2</sup> Follow-up studies of individuals who were exposed to high levels of the OP compound have shown an emergence of certain similar types of neurobehavioral changes, which has been termed together as COPIND.<sup>3</sup> The neurobehavioral changes include anxiety, mood swings, emotional lability, depression, fatigue, irritability, drowsiness, confusion, and lethargy.<sup>4</sup> The purpose of this case study is to determine the neuropsychiatric manifestation of prolonged exposure to OP compounds. As few cases of this kind have been reported or seen in practice, this report may help others in understanding and diagnosing COPIND.

## Case report

In an attempted suicide after quarreling with his wife, a 35-year-old male farmer from the plain (Terai) region of Nepal poisoned himself with OP pesticide (malathion). He had been using OP as a pesticide in his field, as per the advice of an agriculture technician, for over a week at the time of the incident. The unconscious farmer was taken to a nearby hospital in India, near the border, where he suffered from vomiting, salivation, and diarrhea. After being on a mechanical ventilator for 9 days, he was brought to the National Medical College and Teaching Hospital, Birgunj, Nepal. The patients' record showed that his symptoms included deep coma (Glasgow Coma Scale E1V1M1), hypotension (80/56 mmHg), tachycardia (128/min), miosis, and

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hypersalivations. The patient was administered activated charcoal and was continuously infused with atropine sulfate. His plasma cholinesterase value was not tested due to the lack of access to the test.

After being brought to the National Medical College and Teaching Hospital, the patient was kept in the intensive care unit under breathing support with a mechanical ventilation and under 24 hours vigilance. His consciousness and respiratory status gradually improved, and he was taken off the mechanical ventilator on the 12th day of his admission. After this time, he developed irritability, restlessness, nonsensical talking, and psychosis. The neurological examination revealed resting and postural tremors, and marked cogwheel rigidity. An examination of his mental status revealed uncooperativeness, irritability, abnormal behavior, decreased volume and pitch of speech, increased reaction time, lability of mood, impaired attention and concentration, and disorientation to time, place, and person. The diagnosis of delirium was made along with a suspicion of Parkinsonism. The antipsychotic drug, quetiapine, was started at a low dose of 25 mg once daily, and then was gradually increased over 3 days to 50 mg, which showed dramatic improvements within 2 days.

By the 18th day of admission, a decision was made to transfer the patient to the Psychiatry Inpatient Department for further management of his psychiatric manifestation, where he was continued on with the same medications. Consistent mood lability, irritability, fatigability, and features of anxiety were observed; however, features of Parkinsonism were seen to be improving.

Through a detailed history from his spouse, friends, and other family members, major medical, surgical, and psychiatric illness, and substance abuse were all ruled out. The patient consumed alcohol occasionally, but did not portray patterns of dependency. In addition, the detailed history explored the attempted suicide and saw it as an impulsive act rather than one motivated by depression. The patients' medical history showed mood swings along with suicidal thoughts were persistent. An antidepressant, fluoxetine 20 mg, was started once daily and suicidal precaution was explained to family members. Upon persistent requests from the family, the patient was discharged with the same medication and advised to return for a 2-week follow-up at the Psychiatry Outpatient Department. Gradual improvement in his mood and behavior was seen at this 2-week follow-up, as well as at the 1-month follow-up. Gradually quetiapine was stopped, but the patient was advised to continue taking fluoxetine.

At the 3-month follow-up, a detailed evaluation revealed that the patient had reached the premorbid level. Fluoxetine was continued for another 6 months then gradually tapered out and discontinued.

Ethical approval from the Institutional Review Committee was obtained before this study. Informed, written consent was taken from the patient prior to the study.

## Discussion

Studies on the long-term effects of high dose OP compound exposure are limited by the non-specific nature of these symptoms, and by the low sensitivity and specificity of the neurophysiological scoring system.<sup>5</sup> Considering our patient, who did not use any precautions while using the OP compound for agricultural purposes for just over a week before his attempted suicide, could easily have been exposed to the OP compound during that period of time. Following this, he then ingested a large amount of the OP compound impulsively and developed neuropsychological symptoms after this. A study done by Jamal et al<sup>6</sup> pointed to a positive link between the long-term low-level exposure to OP and the development of chronic neurotoxic and neuropsychological effects. A similar study among agriculture workers who were exposed to OP compound showed that they developed neuropsychiatric problems such as anxiety, depression, and problems with memory and concentration.<sup>5</sup> In addition, schizophrenia like psychosis, mood lability, recurrent suicidal ideations, delirium, and aggression have been reported, which was consistent with our study. The mechanisms of the development of these symptoms remain unclear; however, such symptoms are often seen during the recovery from cholinergic syndrome.<sup>3</sup> Extra pyramidal symptoms, such as tremor and cogwheel rigidity, were also seen in our patient in the initial phase of treatment and subsided after approximately 2 weeks, which was consistent with findings from another study.<sup>5</sup> These extra pyramidal symptoms are thought to be due to the inhibition of acetylcholinesterase in the human extrapyramidal area.<sup>7</sup>

After 2 weeks of treatment, the patient developed mood swings and suicidal thoughts, which were not present before exposure to OP pesticides. A study by Davies et al revealed that suicidal thoughts in OP victims tend to come on suddenly and abate quickly.<sup>4</sup> Even though the suicidal thoughts were brief in the absence of major affective disorder, the patient was closely observed and was given antidepressants. A past study have also pointed out the need for hospitalization and close observation in such a type of condition.<sup>4</sup> Moreover,

even if the typical portrayal is of brief impulsive suicidal thoughts, this later may become more persistent suicidal thoughts due to the levels of exposure.<sup>4</sup>

Following recurrent brief suicidal thoughts and mood swings, the patient was started with an antidepressant, which has been found to be effective in the past. A significant proportion of patients diagnosed with COPIND have found that selective serotonin reuptake inhibitors, especially fluoxetine 20 mg, can be beneficial for treating both suicidal thoughts and mood swings.<sup>4</sup> In addition to pharmacological therapy, psychological approaches have also been found to be effective in such cases, although we did not consider it due to the lack of access. Cognitive therapy, similar to those used in chronic or degenerative neurological conditions, is the most appropriate, as they essentially involve problem solving and coming to terms with the disability.<sup>4</sup>

## Conclusion

The neuropsychological problems associated with prolonged exposure of OP compounds need to be studied using a systematic and methodical approach. There is a need of appropriate assessment and diagnosis in the early stages of exposure, which would assist in formulating appropriate strategies to manage such cases with the available resources. Careful monitoring of these disorders not only reduces the treatment costs but also reduces associated morbidity and mortality.

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