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CASE REPORT

# Managing atropine-induced psychosis in organophosphate poisoning: A case report

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## Abstract

Atropine-induced psychosis, though rare, is a critical adverse effect that can arise during the treatment of organophosphate (OP) poisoning, necessitating swift recognition for optimal patient care. This case report describes the presentation of a 45-year-old male with a history of chronic alcoholism and smoking, admitted for OP intoxication, who developed acute psychosis after atropine administration. The symptoms included hallucinations, agitation, and delirium, with diagnostic evaluation confirming atropine-induced psychosis according to DSM-IV-TR criteria. The treatment approach involved discontinuing atropine and providing supportive care, which resulted in symptom resolution within several days. In addition, benzodiazepines were administered to manage agitation and anxiety. This case highlights the need for careful monitoring of drug reactions, particularly in patients with risk factors, such as chronic alcoholism. It underscores the importance of individualized treatment strategies and the critical role of healthcare professionals in recognizing and addressing atropine-induced psychosis. Further research is warranted to better understand the underlying mechanisms and risk factors associated with this complication.

***Keywords:*** Atropine-induced psychosis; Organophosphate poisoning; Adverse drug reactions; Psychiatric manifestations; Management strategies

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## 1. Background

Organophosphate (OP) insecticide poisoning remains a significant global health challenge, contributing to an estimated 100,000 deaths annually worldwide.[1] These compounds exert their toxic effects by inhibiting acetylcholinesterase, leading to the accumulation of acetylcholine at cholinergic synapses and resulting in acute cholinergic syndrome.[2] Atropine, a naturally occurring alkaloid extracted from plants such as deadly nightshade (*Atropa belladonna*), is commonly employed as an antidote in the management of OP poisoning. However, high doses of atropine can cause adverse effects, including the rare but serious complication of atropine-induced psychosis.[3]

Atropine functions by antagonizing the muscarinic effects of acetylcholine in both the central and peripheral nervous systems, blocking neurotransmitter actions on post-ganglionic nerves and smooth muscles.[4] Common side effects, such as xerostomia, photophobia, blurred vision, and tachycardia, typically occur at or below therapeutic doses. However, at toxic doses, more severe adverse effects, including dilated pupils, marked palpitations, restlessness, tremors, delirium, hallucinations, and fatigue, can

occur.[5] Among these, atropine-induced psychosis is a rare phenomenon characterized by symptoms such as restlessness, excitement, hallucinations, and delirium following atropine administration.[4] Although atropine administration for OP poisoning is generally well-tolerated, allergic or toxic reactions, including atropine-induced psychosis, are infrequently reported in the literature.[6]

Atropine-induced psychosis, though rare, is a potentially serious adverse effect observed following atropine administration, particularly in the context of OP poisoning.[7] While the exact mechanisms underlying this psychosis remain unclear, several hypotheses have been proposed, including disruption of central cholinergic neurotransmission, altered dopaminergic signaling, and modulation of glutamatergic and GABAergic pathways.[8] Clinically, this condition resembles acute psychotic disorders, such as schizophrenia or substance-induced psychosis, and is marked by hallucinations, delusions, agitation, confusion, and disorientation.[9] Patients may exhibit erratic behavior, paranoia, and perceptual disturbances, often requiring close monitoring and intervention to ensure their safety and prevent harm.[4,10]

Several factors may pre-dispose individuals to atropine-induced psychosis, including advanced age, pre-existing psychiatric disorders, substance abuse, polypharmacy, and underlying medical comorbidities.[6,11] Elderly patients are particularly vulnerable due to age-related changes in drug metabolism, altered blood-brain barrier permeability, and reduced tolerance to anticholinergic effects.[7,12] Comorbidities such as dementia, Parkinson's disease, cerebrovascular disease, and cardiovascular disorders may further increase susceptibility by disrupting neurotransmitter balance or impairing cognitive function.[13] The concomitant use of medications with anticholinergic properties, such as antipsychotics, antidepressants, antihistamines, and antiparkinsonian agents, may also heighten the risk of psychosis.[14]

Diagnosing atropine-induced psychosis requires a comprehensive clinical assessment, including a detailed patient history, mental status examination, physical evaluation, and exclusion of other causes.[15] The DSM-5 criteria for substance-induced psychosis include the onset of psychotic symptoms related to substance use, the absence of a primary psychotic disorder, and the resolution of symptoms following cessation of the substance.[8,14] Laboratory tests and neuroimaging may be necessary to rule out other conditions that could contribute to psychosis, such as metabolic disturbances, infections, or drug intoxication.[11] Toxicology screening for serum or urine levels of atropine can provide supportive evidence for diagnosis.[16]

Management of atropine-induced psychosis involves a multifaceted approach, including the discontinuation of atropine, supportive care, pharmacological interventions, and psychosocial support. Prompt recognition and cessation of the offending drug are crucial to preventing further complications.[17,18] Supportive measures, such as providing a calm environment and close supervision, are essential for managing agitation and behavioral disturbances.[17-19] Pharmacological treatments may involve the use of antipsychotic medications, such as haloperidol, risperidone, or olanzapine, as well as benzodiazepines to manage acute agitation and anxiety.[20] Psychosocial interventions, including psychoeducation, cognitive-behavioral therapy, and family support, play a key role in recovery and rehabilitation.[20] Close monitoring of clinical responses, side effects, and the risk of relapse is important to optimize outcomes and prevent recurrence.[19,20]

OP poisoning and atropine-induced psychosis present complex clinical challenges, especially in elderly patients with comorbidities. Effective management requires a multidisciplinary approach, integrating expertise in toxicology, pharmacotherapy, psychiatry, and geriatric medicine to address the various complications associated with OP exposure and anticholinergic therapy. By promoting early recognition and implementing evidence-based interventions, healthcare providers can improve outcomes for elderly individuals at risk of OP poisoning and atropine-induced psychosis. Continued research and collaboration are needed to better understand the pathophysiology, risk factors, and treatment strategies of these conditions, ultimately improving care for vulnerable populations.

We present a case report illustrating atropine-induced psychosis during the treatment of OP intoxication. Through this report, we aim to elucidate the clinical presentation, diagnostic approach, management strategies, and outcomes of this rare adverse drug reaction, emphasizing the importance of vigilance in monitoring and managing complications associated with atropine therapy in OP poisoning.

## 2. Case presentation

A 45-year-old male presented to the General Medicine unit of OHRC, Hyderabad, India after ingesting 250 – 500 mL of phenthoate insecticide at his residence. He was initially treated at a local hospital, where atropinization and gastric lavage were performed. The details of the patient are summarized in Table 1.

Upon transfer to a tertiary care facility, a repeat gastric lavage was performed, and the patient received 1 g of pralidoxime (PAM) along with an atropine infusion at 30 mL/h. Hit treatment regimen also included ceftriaxone (1 g IV *Bis die* [BD]), thiamine (100 mg IV BD),

pantoprazole (40 mg IV BD), ondansetron (4 mg IV BD), a multivitamin (1 amp IV *Omni die*), sucralfate (10 mL oral *Ter in die*), and haloperidol (5 mg IM) (Table 2).

**Table 1. Case details**

| Category | Details |
|---|---|
| Patient information | 45-year-old male |
| Presentation | Ingestion of 250 – 500 mL phenthoate insecticide |
| Initial treatment (local) | Atropinization and gastric lavage |
| Treatment on transfer | Repeat gastric lavage, 1 g pralidoxime, atropine infusion (30 mL/h) |
| Medications | As per the treatment chart (Table 2) |
| Clinical monitoring | Drug interactions and adverse reactions monitored by clinical pharmacists |
| Key drug interactions | • Pralidoxime enhancing atropine effects<br>• Additive anticholinergic effects with antipsychotics |
| Patient counseling | Focused on:<br>• Medication adherence<br>• Lifestyle modifications (stress management, fasting, physical activity, social engagement, meditation) |
| Special considerations | • Administer atropine before pralidoxime for muscarinic symptoms<br>• Use benzodiazepines for seizure management |
| Trauma protocols | Airway management emphasized |
| Atropine-induced psychosis management | • Discontinue atropine<br>• Consider alternative muscarinic agents (physostigmine, glycopyrrolate, scopolamine)<br>• Use haloperidol and benzodiazepines for symptom control |
| Anticholinergic selection | Tailored based on receptor targeting |

Clinical pharmacists closely monitored the patient for potential drug interactions and adverse reactions, paying particular attention to the enhancement of atropine's effects by PAM and the additive anticholinergic effects when combined with antipsychotics. Patient counseling focused on medication adherence and lifestyle modifications, emphasizing stress management, fasting, physical activity, social engagement, and meditation.

Administering atropine before PAM was highlighted to mitigate muscarinic-mediated symptoms, and benzodiazepines were recommended for seizure management. Trauma protocols, particularly those emphasizing airway integrity, were followed, and anticholinergic selection was tailored based on receptor targeting. Management of atropine-induced psychosis involved discontinuing atropine and considering alternative muscarinic agents, such as physostigmine, glycopyrrolate, or scopolamine. Antipsychotics, such as haloperidol and benzodiazepines were also recommended for symptom control.

## 3. Discussion

Atropine-induced psychosis is a rare but clinically significant adverse effect observed in the management of OP poisoning. While atropine is a cornerstone treatment for OP toxicity due to its potent anticholinergic properties, its use, particularly at high doses, can lead to adverse reactions, including psychosis. This discussion delves into recent case studies, management strategies, and adverse drug reactions associated with atropine-induced psychosis. Recent case studies have highlighted the occurrence and management of atropine-induced psychosis. For instance, a study of 292 cases of phenthoate (the World Health Organization Class II OP insecticide) self-poisoning reported less severe

**Table 2. Treatment chart**

| Medication | Dose | Route | Frequency | Indication | Special Notes |
|---|---|---|---|---|---|
| Atropine | Infusion at 30 mL/h | IV Infusion | Continuous | Management of muscarinic symptoms | Administered before pralidoxime to mitigate muscarinic effects |
| Pralidoxime | 1 g | IV | BD | Antidote for organophosphate poisoning | Enhances the effect of atropine; repeat dosing at BD intervals |
| Ceftriaxone | 1 g | IV | BD | Prophylaxis for potential infections | Broad-spectrum antibiotic |
| Thiamine | 100 mg | IV | BD | Nutritional support | Prevents Wernicke's encephalopathy |
| Pantoprazole | 40 mg | IV | BD | Gastric protection | Proton pump inhibitor |
| Ondansetron | 4 mg | IV | BD | Nausea and vomiting control | Antiemetic |
| Multivitamin | 1 amp | IV | OD | Nutritional support | Single daily dose |
| Sucralfate | 10 mL | Oral | TID | Gastric mucosal protection | Protects against gastric irritation from ingested substances |
| Haloperidol | 5 mg | IM | As needed | Management of atropine-induced psychosis | Antipsychotic; used for symptom control |

Notes: amp: Ampoule; BD: *Bis die* (twice daily); OD: *Omni die* (once daily); IM: Intramuscular administration; IV: Intravenous administration; TID: *Ter in die* (3 times a day).

poisoning compared to other OP insecticides, with a case fatality rate of 6.5%.[1] Notably, while most patients presented fully alert, a minority exhibited impaired consciousness.[1] This variability in clinical presentation underscores the need for individualized treatment approaches based on the severity of poisoning.

Atropine's potent pharmacological effects make it widely used in the management of OP poisoning. However, adverse effects, including psychosis, can occur, necessitating prompt recognition and intervention. The diagnosis of atropine-induced psychosis aligns with the DSM-IV-TR criteria, with patients often meeting at least three of the four criteria for drug-induced psychosis.[2] Management strategies involve discontinuing the causative agent, adjusting the dose, and providing symptomatic treatment.

In cases of atropine-induced psychosis, discontinuation of atropine and substitution with alternative muscarinic agents such as physostigmine, glycopyrrolate, or scopolamine have been effective in alleviating psychotic symptoms.[3] In addition, antipsychotics, such as haloperidol and benzodiazepines, such as diazepam or lorazepam, are viable treatment options.[3] It is crucial to note that adverse drug reactions can occur with atropine therapy, particularly when administered intravenously, emphasizing the importance of vigilant dose management and early cessation of the offending drug to prevent further complications.[4]

Recent advancements in understanding atropine-induced psychosis have elucidated its pathophysiological mechanisms and pre-disposing factors. Hypotheses regarding the underlying mechanisms include disruption of central cholinergic neurotransmission, altered dopaminergic signaling, and modulation of glutamatergic and GABAergic pathways.[5] Pre-disposing factors such as advanced age, pre-existing psychiatric disorders, substance abuse, polypharmacy, and underlying medical comorbidities increase susceptibility to atropine-induced psychosis.[4] Moreover, the concomitant use of other medications with anticholinergic properties, such as antipsychotics, antidepressants, antihistamines, and antiparkinsonian agents, may potentiate the risk of psychosis.[6] Close monitoring and comprehensive clinical assessment are essential for accurate diagnosis and timely intervention.

## 4. Conclusion

Atropine-induced psychosis remains a rare but potentially serious complication in the management of OP poisoning. Recent case studies provide insights into its occurrence and management strategies, emphasizing the need for vigilant monitoring and individualized treatment approaches. Understanding adverse drug reactions, pathophysiological mechanisms, and pre-disposing factors are critical in managing this complex clinical condition. Continued research efforts are warranted to further elucidate its underlying mechanisms and optimize treatment outcomes, ultimately improving patient care and safety.

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## Conflict of interest

Dr. Mohammed Misbah Ul Haq is an Editorial Board Member of this journal, but was not in any way involved in the editorial and peer-review process conducted for this paper, directly or indirectly. Separately, other authors declared that they have no known competing financial interests or personal relationships that could have influenced the work reported in this paper.

## Author contributions

*Conceptualization:* All authors
*Formal analysis:* All authors
*Investigation:* All authors
*Writing-original draft:* All authors
*Writing-review and editing:* All authors

## Ethics approval and consent to participate

This case report is exempt from institutional review. Per our institutional guidelines, case reports of three or fewer patients do not require institutional review board approval. Verbal consent was obtained from the patient.

## Consent for publication

Verbal consent to publish his data was obtained from the patient.

## Availability of data

The datasets used and/or analyzed during the current study are available from the corresponding author upon reasonable request.

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