ACN
ANNALS OF CLINICAL NEUROPHYSIOLOGY

CASE REPORT
Ann Clin Neurophysiol 2018;20(1):41-43
https://doi.org/10.14253/acn.2018.20.1.41

Intermediate syndrome after dermal exposure to organophosphate insecticide

Su Bin Lee, Seung Ho Ryu, Doo Yong Park, Jong-Ho Park, and Jee Young Kim

Department of Neurology, Myongji Hospital, Seonam University College of Medicine, Goyang, Korea

Intermediate syndrome (IMS) typically occurs at 24–96 hours following organophosphate (OP) poisoning, after an acute cholinergic crisis, but before OP-induced delayed polyneuropathy. It is characterized by proximal muscle weakness and respiratory insufficiency, which is a major contributing factor of OP-related morbidity and mortality. We report an atypical IMS case showing rapid-onset ascending paralysis and respiratory disturbance with an acute cholinergic crisis occurring 4–5 days after skin exposure to OP.

Key words: Organophosphate poisoning; Respiratory insufficiency; Cholinergic

Received: June 13, 2017
Revised: November 19, 2017
Accepted: December 7, 2017

Correspondence to
Jee Young Kim
Department of Neurology, Myongji Hospital, Seonam University College of Medicine, 55 Hwasu-ro 14beon-gil, Deogyang-gu, Goyang 10475, Korea
Tel: +82-31-810-6130
Fax: +82-31-969-0500
E-mail: nrkjy55@gmail.com

The manifestations of acute organophosphate (OP) insecticide poisoning can be classified into three phases: acute cholinergic crisis, intermediate syndrome (IMS), and delayed neuropathy.[1] IMS usually occurs 2–4 days after OP exposure, with a prevalence of approximately 20% following oral exposure to OP pesticides.[2] The characteristic features of IMS are proximal muscle weakness and respiratory failure.[2] It has been considered a major contributing factor of OP-related morbidity and mortality.[2] The vast majority of OP poisoning cases are accidental or occupational from the use of pesticides in rural areas of developing countries, but the main cause of hospital admission is high-dose oral ingestion in suicide attempts.

Here we report an unusual case of IMS following skin exposure to OP insecticide for alleviating severe skin problems.

CASE

A 32-year-old man was taken to the emergency room due to respiratory difficulty, salivation, nausea, vomiting, diarrhea, and weakness in both legs. He also showed diaphoresis and tremulousness. His mother reported that he had been torpid on the previous day. He had suffered from severe seborrheic dermatitis for a long time but denied any other medical history. He was alert and oriented. A neurologic examination showed miotic pupils,

http://www.e-acn.org
pISSN 2508-691X
eISSN 2508-6960

decreased pinprick and temperature sensations involving the right side of the face and left extremities, and weakness in both legs (Medical Research Council score of 3 out of 5). The findings of diffusion-weighted brain magnetic resonance imaging were normal, but soon after that scanning he showed abduction limitation of the bilateral eyes, mild facial diplegia, and left arm weakness. A cerebrospinal fluid (CSF) study was performed for the differential diagnosis of Guillain-Barré syndrome (GBS). In his CSF, the cell count was 0 cells/mm^3, the glucose level was 65 mg/dL (78 mg/dL in plasma), and the protein level was 35 mg/dL. His mother stated that he had applied the OP insecticide trichlrofon to his entire body 5 days previously with the aim of alleviating seborrheic dermatitis.

He experienced a sudden-onset generalized tonic-clonic seizure at around 1 a.m. on the following day. His oxygen saturation level dropped and respiratory acidosis was observed. Endotracheal intubation and mechanical ventilation were applied. A nerve conduction study (NCS) and repetitive nerve stimulation test (RNST) were performed. His NCS findings were normal, while the RNST revealed low-amplitude compound muscle action potentials (CMAPs) in the trapezius muscle and flexor carpi ulnaris (FCU) muscle, a single supramaximal electrical-stimulus-induced repetitive response, and a decrement response to tetanic stimulation; all of these observations were suggestive of OP poisoning (Fig. 1).

The serum level of cholinesterase was 4 IU/L (normal range 203–460 IU/L). We started atropine intravenous injection (80 mg/day) and pralidoxime infusion (12 g for 12 hours) immediately, which slightly improved his muscular weakness but did not significantly improve his respiratory difficulty or neck flexor weakness. We therefore maintained him on pralidoxime for 6 days, after which he was successfully extubated. He had almost completed recovered at 15 days after his hospitalization, when follow-up NCS and RNST were performed. The follow-up NCS produced normal findings, and the second RNST showed that the CMAP amplitudes in the trapezius and FCU muscles were increased and that the single supramaximal electrical-stimulus-induced repetitive response had disappeared. His serum cholinesterase level had normalized to 224 IU/L.

DISCUSSION

The distinctive findings of our case are summarized as follows: 1) clinical manifestations of IMS accompanied by numerous cholinergic signs, including lacrimation, diaphoresis, diarrhea, vomiting, and seizure; and 2) cause of OP poisoning being intentional dermal exposure to alleviate chronic skin problems 4–5 days before the onset of symptoms.

OP compounds irreversibly inhibit the enzyme acetylcholinesterase—which plays an important role at muscarinic and nicotinic nerve endings as well as at central nervous system synapses—to form acetylcholinesterase–OP complexes.[3] The inhibition of acetylcholinesterase by OP results

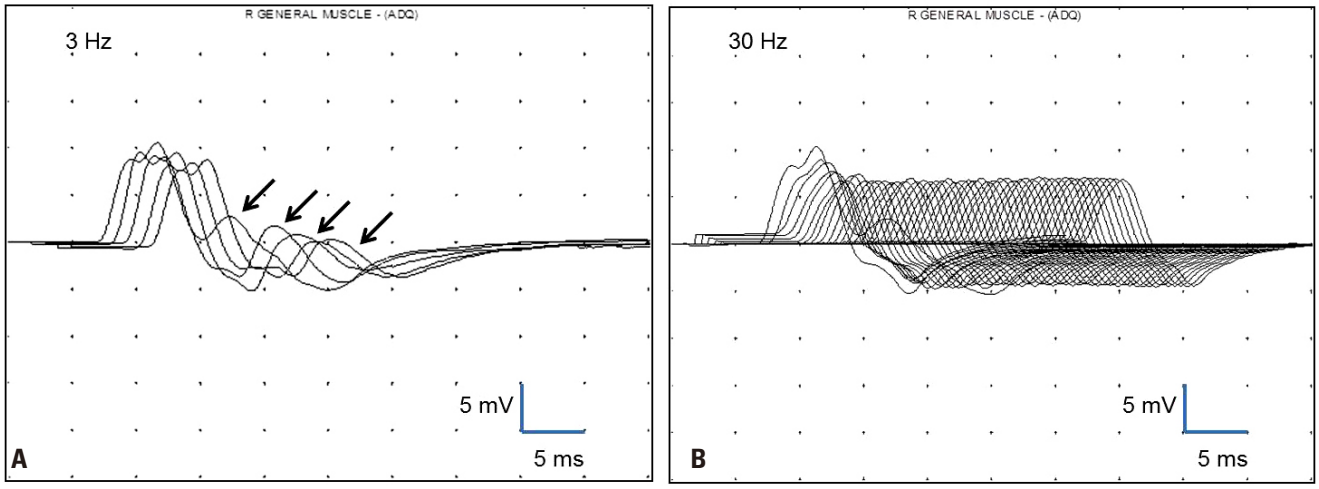

Fig. 1. Results of a repetitive nerve stimulation test (RNST) applied to the abductor digiti minimi muscle of a 32-year-old man. (A) A 3-Hz RNST elicited a single supramaximal electrical-stimulus-induced repetitive response (arrows). (B) A decremental response to a 30-Hz RNST was recorded.

https://doi.org/10.14253/acn.2018.20.1.41

in the accumulation of acetylcholine, which binds to muscarinic and nicotinic receptors and produces various clinical manifestations.

Poisoning with OP insecticides is a worldwide issue that occurs mainly due to occupational or accidental exposure in rural areas, unintentional exposure, or suicidal attempts.[3] Our patient intentionally applied OP to his entire body with the aim of relieving symptoms of intractable seborrheic dermatitis based on the recommendation of his neighbors.

The patient had begun to feel weakness all over his body at 4 days after applying OP. On the following day his weakness had become aggravated, and he presented with rapidly progressive ascending paralysis, proximal and neck flexor weakness, and respiratory distress as well as cholinergic symptoms of lacrimation, diaphoresis, diarrhea, and vomiting. He initially showed rapid-onset ascending paralysis, which is similar to GBS, but we could not find any evidence for this in the CSF studies and the first and follow-up NCSs. The first RNST showed a single supramaximal electrical-stimulus-induced repetitive response and decrement at high stimulation rates. Based on his clinical manifestations and electrophysiologic results, he was diagnosed with IMS induced by OP poisoning.

It is reported that the typical manifestations of IMS occur at 24–96 hours after exposure to various OP agents, following an acute cholinergic crisis.[2] Few patients with atypical manifestations of IMS with relapse or the continuation of the acute cholinergic crisis have been reported.[4,5] A prospective study of 19 patients with OP poisoning identified 8 patients with IMS, of which 6 experienced a short relapse of cholinergic signs superimposed on IMS.[4] Another study found 3 of 21 IMS cases with "rebounding of an acute cholinergic crisis" prior to the development of IMS.[5]

The pathomechanism underlying IMS remains unknown. The various clinical symptoms and disease courses might be due by several factors, including individual differences in the metabolism of OP insecticides, severity of acetylcholinesterase inhibition, or susceptibility of cholinergic receptors distributed throughout the body.

IMS has been considered a major cause of mortality and morbidity in patients presenting with OP poisoning, and so early detection of symptoms and prompt intervention with respiratory care is the mainstay of management. Recovery from a failure of neuromuscular transmission by OP poisoning depends on the reactivation of this enzyme–OP complex, which might be achieved by the rapid administration of oximes such as pralidoxime and obidoxime before the acetylcholinesterase–OP complex has had a chance to age.[3]

A cochrane review considered that the current evidence is insufficient to indicate whether oximes are harmful or beneficial.[6] The present case suggests that appropriate respiratory care with continuous monitoring is essential for treating IMS patients, and that the rapid administration of oximes might be beneficial for some patients with IMS. More randomized clinical trials are necessary to establish suitable guidelines for oxime therapy.

REFERENCES

1. Kang SY, Kim KK. Clinical review of organophosphate poisoning & sequelae; organophosphate induced delayed polyneuropathy. J Korean Neurol Assoc 1999;17:266-274.
2. Karalliedde L, Baker D, Marrs TC. Organophosphate-induced intermediate syndrome: aetiology and relationships with myopathy. Toxicol Rev 2006;25:1-14.
3. Singh G, Khurana D. Neurology of acute organophosphate poisoning. Neurol India 2009;57:119-125.
4. De Bleecker J, Van den Neucker K, Colardyn F. Intermediate syndrome in organophosphorus poisoning: a prospective study. Crit Care Med 1993;21:1706-1711.
5. He F, Xu H, Qin F, Xu L, Huang J, He X. Intermediate myasthenia syndrome following acute organophosphates poisoning: an analysis of 21 cases. Hum Exp Toxicol 1998;17:40-45.
6. Buckley NA, Eddleston M, Li Y, Bevan M, Robertson J. Oximes for acute organophosphate pesticide poisoning. Cochrane Database Syst Rev 2011;(2):CD005085.