

An Unusual Cause for Cardiac Arrest

B. TEAGUE, J. V. PETER, M. O'FATHARTAIGH, A. R. PEISACH
Intensive Care Unit, The Queen Elizabeth Hospital, Woodville, SOUTH AUSTRALIA

ABSTRACT

We report a case of organophosphate poisoning presenting as a cardiac arrest. The diagnosis was delayed due to the absence of a history of insecticide ingestion and the unusually acute presentation. Cardiac arrest with bradycardia poorly responsive to adrenaline and responsive to high dose atropine should alert the clinician to the possibility of an anticholinesterase poisoning. Early diagnosis is essential in order to manage these patients appropriately and increase the probability of survival. (Critical Care and Resuscitation 1999; 1: 362-365)

Key words: Organophosphate poisoning, anticholinesterase, collapse, cardiac arrest

Insecticide poisoning, though a common cause of poisoning in some regions,¹⁻³ is an uncommon cause of admission to the intensive care unit (ICU) in developed countries. Typically, the patient presents with a history of ingestion of, or exposure to, an organophosphate (OP) compound, and clinical features of altered neurological state, muscle fasciculations, bradycardia, pinpoint pupils, sweating and a characteristic insecticide odour.^{4,5} We report a patient who presented as a cardiac arrest and in whom the early diagnosis of OP poisoning was missed because of the absence of a history of insecticide ingestion and an unusually acute presentation.

CASE REPORT

A 68-year-old male presented with a history of collapse. He had a past history of right inguinal hernia repair, chronic back pain, depression and had attempted suicide with corrosives five years prior to this admission. An oesophageal stricture developed following the corrosive ingestion which required an oesophageal bypass and feeding jejunostomy. There had been no recent change in his mood or behaviour.

On this admission, his wife reported that she observed an unsteadiness in his gait when she returned from a shopping trip, and called an ambulance thirty minutes later when the patient collapsed. Initial assessment by the ambulance officers revealed an unconscious apnoeic and pulseless male, with a Glasgow coma score (GCS) of 3. There were copious oral secretions and the pupils were recorded as 'untestable'.

The ECG revealed a bradycardia at 20 beats per minute.

The patient was intubated and cardiopulmonary resuscitation commenced. After 15 minutes of resuscitation and 6 mg of adrenaline, a pulse became palpable, although the patient failed to regain consciousness and required continuous mechanical ventilation.

On arrival at the emergency department, the patient had a heart rate of 122, with no recordable blood pressure, 'pinpoint' pupils, no spontaneous respiratory effort and a GCS of 3. His temperature was 34.5°C. A chemical odour and blue coloured fluid which was aspirated from the feeding jejunostomy tube were noted. The patient was resuscitated further using 1.5 L of 0.9% saline, 1 L of Haemaccel™ and 5 mg of metaraminol. Ninety minutes after admission, the patient was transferred to the ICU with a pulse rate of 46 beats per minute and a systolic blood pressure of 40 mmHg.

In the ICU, the patient remained bradycardic and hypotensive. The ECG revealed complete heart block. Pupil diameters were 2 mm with a sluggish response to light but after one hour, the pupils became pinpoint. The insecticide odour of the jejunostomy fluid and the clinical presentation of an unresponsive patient with miosis, marked salivation, bradycardia and hypotension suggested a diagnosis of an anticholinesterase poisoning. The patient was given a 2 mg dose of atropine intravenously and an atropine infusion was commenced resulting in sinus rhythm with a heart rate to 100 beats per minute and a systolic blood pressure of 100 mmHg. The plasma cholinesterase level of 0.7 kU/L confirmed the diagnosis of an anticholinesterase

Correspondence to: Dr. J. V. Peter, Intensive Care Unit, The Queen Elizabeth Hospital, Woodville, South Australia 5011

poisoning.

During the following 24 hours, despite activated charcoal, mechanical ventilation, increasing atropine, adrenaline and intravenous fluid therapy, the patient continued to deteriorate. The patient died within 24 hours of admission as a result of a prolonged and resistant cardiac arrest.

DISCUSSION

The absence of a history of an insecticide ingestion and acute presentation of cardiopulmonary arrest resulted in a delay in diagnosis and specific treatment in this patient. When the diagnosis was finally made, he initially responded to atropine but subsequently developed refractory cardiogenic shock and renal failure. Pralidoxime (PAM) was not administered due to the unknown time of ingestion and unknown identity of the anticholinesterase (e.g. OP or carbamate) ingested, as well as the fact that PAM may increase respiratory complications and mortality.⁶⁻¹⁰

We found this case instructive for the following reasons: 1) the unusual mode of an OP poisoning presenting as a cardio-respiratory arrest, 2) the possible desirability of using atropine empirically in a collapsed patient, who displays a combination of features including marked bradycardia, hypotension and pinpoint pupils and 3) the importance of considering insecticide poisoning as a cause of cardiac arrest and collapse. It is possible that early recognition and prompt treatment of poisoning in this patient may have resulted in a different outcome.

Anticholinesterase poisoning usually presents with non-specific gastrointestinal symptoms of vomiting, diarrhoea and abdominal pain. Subsequent clinical manifestations are multi-systemic and involve muscarinic, nicotinic and central receptor stimulation. The spectrum of findings range from muscle fasciculations, cramps and twitching to weakness and paralysis requiring mechanical ventilation.¹¹ Cardiac complications include tachycardia or bradycardia (depending on whether nicotinic or muscarinic effects predominate), prolonged QT_c and PR interval and arrhythmias.¹²

In a systematic analysis of 47 patients with OP or carbamate poisoning, Saadeh *et al* reported cardiac manifestations ranging from extrasystoles to ventricular fibrillation (Table 1).¹³ In a recent study of 223 patients with OP poisoning, QT_c prolongation at admission was found to be associated with a higher mortality and respiratory failure.¹⁴ Kiss and Fazekas, in their series of 168 patients, reported electro-cardiographic changes, correlating with the severity of intoxication in 134 patients within 1 to 20 days after exposure.¹⁵ In the majority of patients who experienced arrhythmias, these

occurred between the 3rd and 15th days after exposure and were not suppressed or prevented by atropine therapy. In another series, Luzhnikov *et al* reported 29 deaths in 183 cases of severe OP intoxication as a result of cardiac arrest secondary to ventricular fibrillation occurring within 6 days of admission.¹² Sudden death occurring many days after clinical stabilisation, presumably due to ventricular fibrillation has also been reported.¹⁶

The mechanism of cardiotoxicity with OP poisoning is unclear. Ludormirsky *et al* described three phases: *phase 1*, a brief period of increased sympathetic tone; *phase 2*, a prolonged period of parasympathetic activity; and *phase 3*, in which Q-T prolongation followed by torsade de pointes ventricular tachycardia and ventricular fibrillation occurred.¹⁷ Many factors predispose to cardiac manifestations and include sympathetic and parasympathetic overactivity, hypoxaemia, acidosis, electrolyte derangements, and a direct toxic effect of the compounds on the myocardium.¹²

In patients with severe OP poisoning, treatment with anticholinergics is still the mainstay of therapy and should be initiated as soon as the airway has been secured. It is recommended that atropine be given as a 2 mg i.v. bolus with subsequent doses of 2-5 mg every 5-15 minutes. In children the initial dose of atropine is 0.05 mg/kg IV with a maintenance dose ranging from 0.02-0.05 mg/kg.¹¹ However, total atropinisation (i.e. that necessary to achieve full mydriasis, heart rate >150 beats per minute and absent bowel sounds) is probably not required, and a dose necessary to keep the heart rate above 100 beats per minute, pupils 'mid size' and bowel sounds present, provides adequate atropinisation without risking cardiac complications, hyperexcitability, restlessness and hyperpyrexia that may occur with total atropinisation.¹¹

Some studies have shown that an atropine infusion compared with bolus doses of atropine at regular intervals, reduces mortality.¹⁸ The dose of atropine required is maximal during the first 24 hours and reduces over the next few days. The mean total requirement of atropine in one series ranged been 140-167 mg.⁸ Bardin *et al* have demonstrated that glycopyrrolate is equally effective with less central nervous system side effects and a greater control of secretions.¹⁹

The management of ventricular arrhythmias in OP poisoning is difficult and therapy has included, electrical cardioversion, lidocaine, bretylium and overdrive pacing (for tachycardias),¹² and intravenous isoproterenol, magnesium and pacing (for bradycardias).^{17,20,21} In one report of severely intoxicated patients, complete replacement of blood (to provide

Table 1. Cardiac manifestations in anticholinesterase poisoning

<i>Electrocardiographic manifestations</i>	
Prolonged QT _c interval	67%
Elevated ST segment	24%
Inverted T waves	17%
Prolonged PR interval	9%
<i>Rhythm abnormalities</i>	
Sinus tachycardia	35%
Sinus bradycardia	28%
Extrasystoles	6%
Atrial fibrillation	9%
Ventricular tachycardia	9%
Ventricular fibrillation	4%
<i>Other manifestations</i>	
Noncardiogenic pulmonary oedema	43%
Hypertension	22%
Hypotension	17%

acetylcholinesterase) resulted in the disappearance of arrhythmias and normalisation of the QT_c.¹²

The role of oximes in the management of anticholinesterase poisoning is controversial. Initial uncontrolled studies suggested that pralidoxime (PAM) was useful in the routine management of OP poisoning,^{22,23} although later studies suggested that PAM was not useful.²⁴⁻²⁶ Subsequently, two major randomised controlled trials suggested that high dose PAM increased mortality and respiratory complications.^{7,8} However, there is a preliminary report that suggests that electrophysiological improvements occur when obidoxime is administered within 12 hours of poisoning, although evidence of acetylcholinesterase inhibition did not subside completely. These improvements were mild or absent when therapy was delayed 26 hours or more.²⁷ It is also possible that the response to PAM may be different for the 'direct' acetylcholinesterase agents as opposed to the 'indirect' agents and this aspect also warrants further study.

While OP has been reported to present with features similar to a brain stem stroke,²⁸ to our knowledge, OP poisoning presenting as cardiac arrest has not been reported.

Received: 3 September 1999

Accepted: 26 November 1999

REFERENCES

1. Shah AC, Trivedi AM, Vishwanath N, et al. Intensive respiratory care service. Organisation, orientation,

system and future. Our experience of management of 288 cases. *J Assoc Physicians India* 1990;38:140-143.

- Jamil H. Organophosphorus insecticide poisoning. *JPMA* 1989;39:27-31.
- Van der Hoek W, Konradsen F, Athukorala K, Wanigadewa T. Pesticide poisoning: a major health problem in Sri Lanka. *Soc Sci Med* 1998;46:495-504.
- Haddad LM. Organophosphates and other insecticides. In: Haddad LM, Winchester J Eds. *Clinical management of Poisoning and Drug overdose*, WB Saunders Company 1990;1076-1087.
- Bardin PG, Eeden SF, Moolman JA, Foden AP, Joubert JR. Organophosphate and carbamate poisoning. *Arch Intern Med* 1994;154:1433-1441.
- Cherian AM, Jeyaseelan L, Peter JV, et al. Pralidoxime in the treatment of organophosphorus poisoning - a randomized, double blind, placebo-controlled clinical trial. *INCLIN Monograph series on Critical International Health Issues No.7 Dec.1997*.
- Johnson S, Peter JV, Thomas K, Jeyaseelan L, Cherian AM. Evaluation of two treatment regimens of pralidoxime (1gm single bolus dose vs. 12 gm infusion) in the management of organophosphorus poisoning. *J Assoc Physicians India* 1996;44:529-531.
- Cherian AM, Peter JV, Samuel J, Jaydevan R, Peter S, Joel S et al. Effectiveness of P2AM in the treatment of organophosphorus poisoning. A randomised, double blind placebo controlled clinical trial. *J Assoc Physicians India* 1997;45:22-24.
- Balali-Mood M, Shariat M. Treatment of organophosphate poisoning. Experience of nerve agents and acute pesticide poisoning on the effect of oximes (abstr.) *J Physiol Paris* 1998;92:375-378.

10. Scott RJ. Repeated asystole following PAM in organophosphate self-poisoning. *Anaesth Intens Care* 1986;14:458.
11. Peter JV, Cherian AM. Organic insecticides: a review. *Anaesth Intens Care* (in press).
12. Roth A, Zellinger I, Arad M, Atsmon J. Organophosphates and the heart. *Chest* 1993;103:576-582.
13. Saadeh AM, Farsakh M, Ali-Ali MK. Cardiac manifestations of acute carbamate and organophosphate poisoning. *Heart* 1997;77:461-464.
14. Chuang FR, Jang SW, Lin JL, Chern MS, Chen JB, Hsu KT. QTc prolongation indicates a poor prognosis in patients with organophosphate poisoning. *Am J Emerg Med* 1996;14:451-453.
15. Kiss Z, Fazekas T. Arrhythmia in organophosphate poisonings. *Acta Cardiol* 1979;34:323-330.
16. Lerman Y, Kirshberg A, Shteger Z. Organophosphate and carbamate pesticide poisoning: the usefulness of a computerised clinical information system. *Am J Med* 1984;6:17-26.
17. Ludomirsky A, Klein H, Sarelli P, Becker B, Hoffman S, Taitelman U et al. Q-T prolongation and polymorphous (torsade de pointes) ventricular arrhythmias associated with organophosphorus insecticide poisoning. *Am J Cardiol* 1982;49:1654-1658.
18. Ram JS, Kumar SS, Jayarajan A, Kuppuswamy G. Continuous infusion of high doses of atropine in the management of organophosphorus compound poisoning. *J Assoc Physicians India* 1991;39:190-193.
19. Bardin PG, van Eeden SF. Organophosphate poisoning: grading the severity and comparing treatment between atropine and glycopyrrolate. *Crit Care Med* 1990;18:956-960.
20. Brill DM, Maisel AS, Prabhu R. Polymorphic ventricular tachycardia and other complex arrhythmias in organophosphate insecticide poisoning. *J Electrocardiol* 1984;17:97-102.
21. Karen A, Tzivoni D, Gavish D, Levi J, Gottlieb S, Benhorin J et al. Etiology, warning signs and therapy of torasde de pointes. *Circulation* 1981;64:1167-1174.
22. Namba T. Cholinesterase inhibition by organophosphorus compounds and its clinical effects. *Bull WHO* 1971;44:289-307.
23. Durham WF, Wayland JH. Organic phosphorus poisoning and its therapy. *Arch Environ Health* 1962; 5:27-47.
24. Namba T, Nolte CT, Jackrel J, Grob D. Poisoning due to organophosphate insecticides. *Am J Med* 1971;50:475-492.
25. Sanderson DM. Treatment of poisoning by anticholinesterase insecticides in the rat. *J Pharm Pharmacol* 1961;13:435.
26. De Silva HJ, Wijewickrema R, Senanayake N et al. Does pralidoxime affect outcome of management in acute organophosphorus poisoning. *Lancet* 1992; 339:1136-38.
27. Besser R, Weilemann LS, Gutmann L. Efficacy of obidoxime in human organophosphorus poisoning: determination by neuromuscular transmission studies. *Muscle Nerve* 1995;18:15-22.
28. Hollis GJ. Organophosphate poisoning versus brainstem stroke. *Med J Aust* 1999;170:596-597.