OPEN ACCESS Freely available online

Journal of Clinical Toxicology

Case Report

Organophosphate Poisoning Complicated by Rhabdomyolysis-Induced Acute Kidney Injury: A Case Report and Review of Literature

JB Gunasena[1*], ST De Silva[1,2]

[1]Colombo North Teaching Hospital, University Medical Unit, Ragama, Sri Lanka; [2]Department of Medicine, University of Kelaniya, Colombo, Sri Lanka

ABSTRACT

Background: Rhabdomyolysis induced acute kidney injury (AKI) following organophosphate poisoning is a rare complication. The mechanism responsible is uncertain.

Case report: A 42 years old male was admitted to a tertiary care hospital in Sri Lanka after deliberate self-ingestion of Calcron® (Profenophos, an organophosphorus pesticide). He developed rhabdomyolysis induced AKI requiring regular haemodialysis. During the hospital stay he also developed bronchopneumonia with acute respiratory distress syndrome, requiring intubation and ventilation. The patient improved with intravenous antibiotics and repeated renal replacement with haemodialysis. At discharge he had made a full recovery.

Conclusion: Organophosphate poisoning can rarely lead to rhabdomyolysis induced AKI. It is an adverse predictor of outcome. Clinicians should be vigilant about this complication since, with early diagnosis and aggressive treatment, a favourable outcome is possible.

Keywords: Organophosphate intoxication; Rhabdomyolysis; Acute kidney injury; Hemodialysis

INTRODUCTION

Farmers in agriculture-based economies of countries such as Sri Lanka frequently use pesticides in their farming activities. Organophosphates (OP) contribute to about 10% of the pesticide imports to Sri Lanka. Chlorpyriphos is the most frequently imported [1].

OP is a common cause of poisoning in the country, leading to significant morbidity and mortality [2]. Over the counter availability of OP has made it a common modality of poisoning among agricultural communities [3,4]. Poisoning can either be by deliberate self-ingestion or by occupational exposure.

Organophosphate poisoning leads to mainly three types of clinical complications:

- Acute cholinergic syndrome
- Intermediate syndrome
- OP induced delayed polyneuropathy

Apart from these common complications rare manifestations such as acute respiratory distress syndrome (ARDS), acute kidney injury (AKI) and sub arachnoid haemorrhage have been reported in literature [5-9].

We report a case of OP poisoning complicated by rhabdomyolysis-induced AKI.

CASE REPORT

A 42 years old male was admitted to the emergency treatment unit 90 minutes after deliberate self-ingestion of Calcron ® (Profenophos, an organophosphorus pesticide). He had a history of hypertension but was not on any regular medication. On admission the patient was hemodynamically stable but had clinical evidence of OP toxicity; pupils were meiotic, blood pressure was 125/74 mmHg, pulse rate was 76 beats per minute and there were increased oral secretions with bilateral lung crepitations on auscultation. GCS on admission was 14/15.

Blood investigations were as follows: white blood cells 13,000/ µl, haemoglobin 10.8 g/dl, platelets 260,500/ µl, creatinine 92.5 µmol/l, sodium 133 mmol/L, potassium 4.4 mmol/l,

Correspondence to: J B Gunasena, Colombo North Teaching Hospital, University Medical Unit, Ragama, Sri Lanka, E-mail: janithag@outlook.com

Received: July 27, 2020; **Accepted**: August 12, 2020; **Published**: August 19, 2020

Citation: Gunasena JB, De Silva ST (2020) Organophosphate Poisoning Complicated by Rhabdomyolysis-Induced Acute Kidney Injury: A Case Report and Review of Literature. J ClinToxicol. 10:450. DOI: 10.35248/2161-0495.20.10.450

arterial pH 7.29, pCO_2 43.6 mm Hg, pO_2 72.6 mmHg, HCO_3^- 21.1 mmol/l, lactate 1.1 mmol/l.

Treatment was commenced according to local guidelines and treatment protocols. Intravenous atropine was administered, and gastric lavage was performed. After the initial loading dose, an infusion of atropine was given, followed by regular dosing of pralidoxime.

On the third day after admission the patient developed myoglobinuria with myalgia, oliguria and deterioration of renal functions. Serum creatinine phosphokinase level rose to 23256 IU/l and rhabdomyolysis induced oliguric AKI was diagnosed. Repeated laboratory investigations at this time showed white blood cell count of 11,000/ µ l, haemoglobin 10.9g/dl, platelets 259,000/ µ l, serum creatinine 753 µ mol/l, sodium 143 mmol/l, potassium 4.6 mmol/l, total calcium 2.2 mmol/l and phosphate 1.4 mmol/l. Hemodialysis was commenced immediately and repeated at regular intervals. Over the next few days the patient developed bronchopneumonia with acute respiratory distress syndrome (ARDS) and type 1 respiratory failure. He required intubation, ventilation and broad-spectrum intravenous antibiotics with ICU care. The patient improved gradually with continued intravenous antibiotics and repeated renal replacement therapy with hemodialysis. On the 41st day of hospitalisation he was discharged after making a complete recovery.

DISCUSSION

This is a rare case of OP poisoning complicated by rhabdomyolysis-induced oliguric AKI. Organophosphates are used as pesticides in agricultural activities, termite treatment and anti-lice and tick products worldwide. The British Medical Journal Best Practice-Organophosphate Poisoning defines OP poisoning as "poisoning occurring after dermal, respiratory or oral exposure to either organophosphate pesticide or nerve agents causing inhibition of acetylcholine esterase at nerve synapses" [10]. OP acts by inhibiting acetylcholinesterase enzyme at neuromuscular junctions of the sympathetic, parasympathetic and central nervous systems, leading to an excess of acetylcholine. This results in parasympathetic effects such as bronchospasms, bronchorrhoea, rhinorrhoea, bradycardia, hypotension and pinpoint pupils. Cholinergic effects on the central nervous system causes seizures, confusion and respiratory failure. Fasciculations and weakness are due to neuromuscular junction stimulation by excess acetylcholine. Treatment options available for OP poisoning include the use of atropine, pralidoxime and gastric decontamination as appropriate [10].

Literature on OP induced renal complications and OP induced rhabdomyolysis is limited, with only a few cases of rhabdomyolysis following OP poisoning being reported. Rhabdomyolysis occurs as a result of skeletal muscle injury with release of intracellular contents and there is a subsequent rise in serum LDH, myoglobin and CPK. Common drugs abused in society and known to cause rhabdomyolysis include cocaine, amphetamines, LSD, heroine, alcohol and phencyclidine [10,11]. The first reported case of OP poisoning induced rhabdomyolysis was in a patient who developed post-synaptic neuromuscular dysfunction with OP-induced intermediate syndrome [12]. In this case, limited rhabdomyolysis was confirmed by tibialis anterior muscle biopsy.

Two case reports of OP poisoning complicated by rhabdomyolysis-induced AKI were reported by Gokel in 2002 [5]. Both patients developed myoglobinuria with elevated CPK, deteriorating renal function and oliguria. They were managed with renal replacement by peritoneal dialysis. Unfortunately, both cases had unfavourable outcomes, with the patients succumbing to cardiac arrest and myocardial infarction respectively. Bardin et al. in a retrospective analysis reported that 13% of treated severe OP poisoning cases developed oliguric AKI. The probable aetiology was thought to be hypovolemia or rhabdomyolysis secondary to prolonged seizure activity [6]. However, our patient did not develop seizures during the course of his illness and remained

haemodynamically stable. OP-induced rhabdomyolysis has also been attributed to excessive muscular activity evoked by the nicotinic effects of accumulated acetylcholine in a case report published by Sheng et al. [13].

Few cases of OP poisoning complicated by renal impairment have been reported in world literature so far. Abend et al. reported a case of AKI following OP poisoning without any evidence of rhabdomyolysis or haemodynamic instability; in fact, the authors were unable to determine a cause for the renal impairment [7]. Wedin et al. described crystalluria as a possible cause of OP poisoning associated kidney injury [8]. Betrosian et al. described a case of AKI secondary to OP poisoning and speculated that acute tubular necrosis due to toxic effect of OP was the likely aetiology [9].

Studies carried out in Sri Lanka in 1988 [2] and 2017 [14] have not identified any cases of OP poisoning complicated by AKI. In a recent study carried out in India, none of the patients who presented with OP poisoning developed AKI as a complication [15]. To the best of our knowledge, ours is the first ever case of rhabdomyolysis induced AKI in a patient with OP poisoning reported from Sri Lanka.

Information on the pathogenetic mechanism of AKI due to OP poisoning is inconclusive since there is a lack of experimental data in the literature and data derived from OP production facilities. However, possible mechanisms are the level of plasma choline esterase in distal convoluted tubules of the kidney, high intralobular OP concentration, rhabdomyolysis and hypovolemia from dehydration [16,17].

The majority of reported cases of OP poisoning induced AKI had unfavourable outcomes despite the patients receiving dialysis. This was attributed to several toxicokinetic effects of OP such as rapid distribution to all tissues and high volume of distribution [18]. The same toxicokineticsfavour the use of continuous veno-venous hemofiltration (CVVH) over haemodialysis in OP induced AKI [16].

CONCLUSION

Rhabdomyolysis induced AKI is a rare complication following OP poisoning and is an adverse predictor of patient outcome. Our patient developed rhabdomyolysis-induced AKI and

improved following repeated haemodialysis, compared to the few previously reported cases managed with peritoneal dialysis. Although both these complications are rare, surveillance of patients following OP poisoning for AKI and rhabdomyolysis is warranted. Haemodialysis appears to be beneficial in OP poisoning induced AKI with rhabdomyolysis but, considering the toxicokinetic effects of OP, CVVH may be a better management option.

REFERENCES

1. Marasinghe JP, Magamage C, Shiromi MG, Aravinna AG. Organophosphate pesticide residues in food commodities in Sri Lanka: A review. Ann Sri Lanka Dep Agri.2011;81:93.
2. Karalliedde L, Senanayake N. Acute organophosphorus insecticide poisoning in Sri Lanka. ForenSci Int.1988;36(1):97-100.
3. Narang U, Narang P, Gupta O. Organophosphorus poisoning: A social calamity. J Mahatma Gandhi Inst Med Sci.2015;20(1):46.
4. Malik GM, Mubarik M, Romshoo GJ. Organophosphorus poisoning in the Kashmir Valley, 1994 to 1997. New Eng J Med. 1998;338(15):1078-1079.
5. Gokel Y. Subarachnoid hemorrhage and rhabdomyolysis induced acute renal failure complicating organophosphate intoxication. Renal Failure.2002;24(6):867-871.
6. Bardin PG, van Eeden SF, Moolman JA, Foden AP, Joubert JR. Organophosphate and carbamate poisoning. Arch Int Med. 1994;154(13):1433-1441.
7. Abend Y, Goland S, Evron E, Sthoeger ZM, Geltner D. Acute renal failure complicating organophosphate intoxication. Renal Failure.1994;16(3):415-417.
8. Wedin GI, Pennente CM, Sachder SS. Renal involvement in organophosphate poisoning. I Am Med Assoc. 2013;252:1408-1984.
9. Betrosian A, Balla M, Kafiri G, Kofinas G, Makri R, Kakouri A. Multiple systems organ failure from organophosphate poisoning. J Toxicol Clin Toxicol.1995;33(3):257-260.
10. Nicholas B. Organophosphate poisoning. BMJ Best Practice.2020.
11. Counselman FL. Rhabdomyolysis. Emergency Medicine 5th. 2000;1841-1845.
12. De Wilde V, Vogelaers D, Colardyn F, Vanderstraeten G, Van den Neucker K, De Bleecker J, et al. Postsynaptic neuromuscular dysfunction in organophosphate induced intermediate syndrome. Klinische Wochenschrift.1991;69(4):177-183.
13. Yeh TS, Wang CR, Wen CL, Chuang CY, Chen CY. Organophosphate poisoning complicated by rhabdomyolysis. J ToxicolClin Toxicol.1993;31(3):497-498.
14. Umakanth M. Prevalence of organophosphate poisoning in Batticaloa, Sri Lanka. Asia Pacific J Med Toxicol.2017;6(4):115-117.
15. Sweni S, Meenakshisundaram R, Sakthirajan R, Rajendiran C, Thirumalaikolundusubramanian P. Acute renal failure in acute poisoning: Prospective study from a tertiary care centre of South India. J Renal Care.2012;38(1):22-28.
16. Agostini M, Bianchin A. Acute renal failure from organophospate poisoning: A case of success with haemofiltration. Human Exp Toxicol.2003;22(3):165-167.
17. Karalliedde L, Senanayake N. Organophosphorus insecticide poisoning. British J Anaesthesia.1989;63(6):736-750.
18. Martinez-ChuecosJu, JuradoMd, GimenezMp, Martinez D, Menendez M. Experience with hemoperfusion for organophosphate poisoning. Critic Care Med.1992;20(11): 1538-1543.