Case Report
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A fatal case of yellow phosphorus poisoning with refractory cardiogenic shock

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Abstract

Yellow phosphorus (YP), is a commonly used rodenticide paste in India. It is a powerful protoplasmic poison leading to acute fulminant hepatic failure, and has 100 % mortality in patients with delayed presentation. We report a case of a 23 year old man, who presented within 24 hours of consumption of 3% YP with the intent of deliberate self harm. He had a fatal course complicated by refractory cardiogenic shock and multi - organ dysfunction syndrome. Prevention strategies including public awareness of toxicity and restriction of sales of this compound are required on an emergent basis.

Keywords: Yellow phosphorus, cardiogenic shock, fatal

KeyMessages: Yellow phosphorus is a highly lethal rodenticide paste. Acute poisoning can cause severe cardio toxicity and is uniformly fatal. Public awareness and restriction of sales are required.

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Introduction

The Vellore district in South India reports the highest incidence of suicides among young people in the world ,with about 148 per 100,000 women and 58 per 100,000 men(1). Rodenticide pastes are commonly used in households and in suburban areas and were brought into use due to the increasing resistance of the rodents to warfarin compounds. Currently 3% YP is manufactured under the trade name "Ratol", which is a cheap, over the counter rodenticide. The main constituent of this paste is white phosphorus, which is a transparent waxy crystalline solid, extracted from phosphate containing rocks(2). The other uses of YP include fireworks and military armament. There are multiple reports of acute fulminant hepatic failure and coagulopathy in human toxicity(3–5).However, acute YP poisoning presenting with severe myocardial dysfunction leading to cardiogenic shock and fatal course is rare, with very few cases being reported in literature(6). We report such a case with a fatal outcome.

Case History

A 23 year old man presented with history of consumption of a tube of 'Ratol' paste mixed in water, with the intention of deliberate self harm. He had multiple episodes of non bilious vomiting within an hour of consumption associated with asthenia and myalgia. He presented to our hospital, 10 hours post consumption, having had stomach wash elsewhere preceding the admission. Clinical examination revealed him to be in severe distress. His pulse rate was 140 beats per minute, respiratory rate was 28 breaths per minute and he was hypotensive with blood pressures of 70/40 mm Hg. His peripheries were cold and clammy with systemic examination revealing diffuse abdominal tenderness. He did not have any bleeding diatheses. Investigations showed haemoglobin of 15.3 gm/dl, total leucocyte counts of 10000 per cubic mm and normal platelet counts. His prothrombin time was 11 seconds with an INR of 1.06 and his APTT was normal. He had severe lactic acidosis with lactate of 9.3 mmol/litre(ref:0.4-1.2).

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Table 1. Laboratory parameters

Investigations	At admission	6 hours post admission	12 hours post admission
Haemoglobin(gm/dl)	15.3	13.6	-
Total leucocyte count(per cu mm)	10000	19200	-
Differential leucocyte count(per cubic mm)	Neutrophil – 76 Lymphocyte-19 Monocyte - 5	Immature precursors – 13 Neutrophil – 48 Lymphocyte - 44	-
Platelets(per cubic mm)	283000	161000	-
Prothrombin time(seconds) (10 – 12.5)	11.6	-	18.8
INR	1.07	-	1.73
APTT(seconds)(22.6 – 42.4)	37	79	>3 MINS
Creatinine(mg%)	0.80	2.35	2.5
Ph	7.34	7.04	6.91
Sodium(mmol/l)	130	135	150
Potassium(mmol/l)	3.0	3.8	3.3
Calcium(mg/l)	0.94	3.71	5.82
Phosphorus(mmol/l)	2.8	-	9.6
Lactate(mmol/l)	9.3	17.8	>20
Base Deficit(mmol/l)	-15.5	-23.8	-24.8

He was initiated on dopamine infusion and was shifted to medical intensive care unit(ICU).He progressed to develop refractory shock requiring supra-maximal doses of adrenaline, noradrenaline ,dopamine and vasopressin. In a period of 6 hours in the ICU, his metabolic acidosis worsened and he progressed to anuric renal failure and coagulopathy (Table 1).Electrocardiogram showed diffuse ST segment elevations with broad QRS complexes. Bedside Echocardiogram revealed severe left ventricular dysfunction with dilatation of cardiac chambers and global hypokinesia. His cardiac ejection fraction was estimated to be 15%.He succumbed to his illness within 24 hours of presentation to the emergency department.

Discussion

Acute YP poisoning is on a rise in the developing nations in view of its easy availability and multiple uses such as in fireworks, match sticks and rodenticides. The estimated lethal dose is about 5 mg/cu mm, with mortality rates varying between 30% - 100%(7).On consumption, it is rapidly absorbed in the gastrointestinal tract and predominantly affects the liver. The mechanism of toxicity is by direct tissue damage through an exothermic chemical reaction which occurs due to interaction of elemental phosphorus with the tissues to produce phosphoric acid and organic phosphate molecule(8).

The toxicity in humans typically manifests in three phases(7,8); the first phase occurs within minutes of consumption to hours, where the most predominant symptom is vomiting and mortality occurs due to ventricular arrhythmias and cardio – vascular collapse. The second phase is an interim period, where the patient remains asymptomatic, which tends to mislead a clinician towards early discharge from hospital. This is followed by the third phase consisting of profound systemic symptoms predominantly that of hepato-toxicity and coagulopathy.

The common causes of mortality are fulminant hepatic failure, acute renal failure, hypoglycemia and cardiovascular collapse .The mechanism of cardio-toxicity is unknown. Autopsy studies have revealed features of myocardial necrosis with fatty infiltration due to micro vesicular steatosis(6).Our patient also had evidence of bone marrow toxicity with presence of immature precursors with toxic changes in the peripheral smear, which has been reported in literature(5).

There is no specific antidote for yellow phosphorus poisoning. Management is essentially supportive and N-Acetyl cysteine has not shown to be beneficial(9). In view of its high lethality, its use should be curtailed

in our community ,considering our high incidence of suicides(10).Public awareness should be reiterated by the manufacturers to prevent accidental as well as deliberate self harm.

Conclusion

Yellow phosphorus is a highly lethal compound, with no specific antidote. Early cardiovascular collapse is a rare presentation with a uniformly fatal outcome. Considering its toxicity, public health initiatives are to be taken to increase public awareness and subsequently ban its use in India.

Conflict of Interest

None Declared

References

1. Aaron R, Joseph A, Abraham S, Muliyil J, George K, Prasad J, et al. Suicides in young people in rural southern India. Lancet Lond Engl. 2004 Apr 3;363(9415):1117–8.
2. CDC - The Emergency Response Safety and Health Database: Systemic Agent: WHITE PHOSPHORUS - NIOSH [Internet].
3. Winek CL, Collom WD, Fusia EP. Yellow phosphorus ingestion--three fatal poisonings. Clin Toxicol. 1973;6(4):541–5.
4. McCarron MM, Gaddis GP, Trotter AT. Acute yellow phosphorus poisoning from pesticide pastes. Clin Toxicol. 1981 Jun;18(6):693–711.
5. Tafur AJ, Zapatier JA, Idrovo LA, Oliveros JW, Garces JC. Bone marrow toxicity after yellow phosphorus ingestion. Emerg Med J EMJ. 2004 Mar;21(2):259–60.
6. Pooja P, Padmakumar A, Suresh CG. Persistent Left Ventricular Dysfunction in a Teenager with Yellow Phosphorous Poisoning. J Case Rep. 2015 Mar 30;5(1):137–40.
7. CDC - Immediately Dangerous to Life or Health Concentrations (IDLH): Phosphorus (yellow) - NIOSH Publications and Products [Internet].
8. PHOSPHORUS, ELEMENTAL - National Library of Medicine HSDB Database [Internet].
9. Bhat S, Kenchetty KP. N-Acetyl Cysteine in the Management of Rodenticide Consumption — Life Saving? J Clin Diagn Res JCDR. 2015 Jan;9(1):OC10-OC13.
10. Mohideen SK, Kumar KS. Should ratol paste be banned? Indian J Crit Care Med Peer-Rev Off Publ Indian Soc Crit Care Med. 2015 Feb;19(2):128–9.