

2-4-D, Sodium Salt Poisoning – A Rare Case Series

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Abstract

Acute poisoning is an important medical emergency. Depending on the socioeconomic factors and cultural diversity, the nature of poison varies throughout the world even in different parts of the same country. Hence, the management of these patients can improve if the common causes of poisoning are properly defined.

Pesticide poisoning is globally the single most important means of suicide. It is a major public health problem in rural Asia, where it has led to a very high-case fatality ratio in comparison to the developed world.

Case Series: we report four cases of extremely rare poisoning with 2-4-D, Sodium Salt, all of which were due to suicidal attempt. In this case series, we attempt to describe the clinical and biochemical profile of this rare poison.

The presenting symptoms were nausea, vomiting, abdominal pain, and altered behavior/sensorium. All cases had hypernatremia/ high anion gap metabolic acidosis, yet the degree of which varied across cases. Two of them had only Hypernatremia and acidosis, and improved with conservative treatment. One of them developed severe renal, hepatic and respiratory failure and succumbed. Another case had hypernatremia, acidosis, AKI. He improved drastically after dialysis. *Conclusion:* We would like to highlight in our case series that timely management, could alter the outcomes in this poisoning.

Keywords: Hypernatremia, Metabolic acidosis Dialysis, Poisoning

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INTRODUCTION

In terms of medical emergency, acute poisoning has been regarded as important and of priority. . The nature of poison is different in different parts of the world depending on the socioeconomic factors and cultural diversity. What is of significance is the proper management of these critically ill patients provided that the common causes of poisoning are appropriately defined.¹

Nearly one million people die each year as a result of suicide and chemicals account for a significant number of these deaths. For example, it is estimated that deliberate ingestion of pesticides causes 370,000 deaths each year².

Pesticides are a large group of heterogeneous chemicals that include a wide range of products, such as insecticides, herbicides, fungicides, and rodenticides³.

Pesticides are designed to kill, reduce or repel insects, weeds, rodents, fungi, and other organisms that can threaten public health and national economies. People can be exposed to excessive pesticide levels while working; via food, soil, water or air; or by directly ingesting pesticide products. Pesticides are known to cause millions of acute poisoning cases each year, of which at least one million patients require hospitalization.^{4,9}

In developing countries, where there are incomplete regulations, a lack of monitoring systems, low enforcement,

lack of training, inadequate access to information systems, poorly managed or non-existent personal protective equipment, and large agricultural-based populations, the incidence of pesticide poisoning is expected to be higher than in developed countries⁵.

Due to its widespread use in agriculture, occupational pesticide poisoning is a major health problem among agricultural workers all over the world. Since they are directly in contact with pesticides through spraying, mixing, handling, and preparing, pesticides poisoning is an important occupational risk among farmers universally. Unsafe and misuses of pesticides can result in serious short-term or long-term health problems⁶

Poisoning by Various 2, 4-D Sodium Salts has been Previously Reported⁷.

Physical and Chemical Properties:

Mode of action: 2, 4-D is used on a wide variety of terrestrial and aquatic broadleaf weeds. It has little effect on grasses. It appears to work by causing uncontrolled cell division in vascular tissue. Abnormal increases in cell wall plasticity, biosynthesis of proteins, and production of ethylene occur in plant tissues following exposure, and these processes are responsible for uncontrolled cell division. The ester forms of 2, 4-D penetrate into foliage, whereas plant

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Table 1. Description of the compound⁸

Technical Name	2-4-D, Sodium Salt 80 % WP
Brand Name	KAY-D-80WP
Type of Pesticide	Herbicide
Chemical composition	2-4-D, Sodium Salt Tech(equivalent of 80% acid content) 94.5 % w/w Water 5.0 % w/w Sodium chloride 0.5 % w/w- Total 100.0 % w/w.
Pack Size	500 gm

roots absorb the salt forms. 2, 4-D appears to be similar in action to other auxin-type herbicides.

Recommendation: It is a selective herbicide and controls broad leaved weeds, sedges and germinating grass seedlings in crops like wheat, maize, citrus, and grapes

Application- It is considered as a solution by mixing the powder with water. The final concentration of which depends on the crop to which it is applied.

Precautions: Follow normal precautions – keep away from food stuff containers and animal food; avoid contact with mouth, eyes and skin; avoid inhalation of the spray mist; spray in the direction of wind; wash the contaminated cloths and parts of body thoroughly after spraying; do not smoke, drink, eat or chew while mixing and spraying; and wear full protective clothing while mixing and spraying.

First Aid: If the product gets into the eyes, rinse it out immediately with plenty of water. In case of poisoning, eliminate active ingredient through inducing vomiting.

Antidote: If ingested, evacuate stomach content by gastric lavage. Quinidine sulphate may be given to control myotonia or suppress abnormal ventricular cardiac rhythm. Treat symptomatically

Urinary alkalinasation has rarely been successfully implemented in poisoning due to other 2, S4-D salts.¹⁰

RESULTS

In this case series which focused on four patients, we made an attempt to describe the clinical and biochemical profile of this rare poison. All the poisoning cases were the results of suicidal attempt. Cholinesterase levels were normal in all of the cases. Poisoning with the compound was confirmed by observing the package. The most common symptoms were vomiting altered behavior/sensorium. Hypernatremia and high anion gap acidosis were the classical features of this poisoning. All the patients were admitted to intensive care unit and received gastric lavage and supportive care. Supportive care included antiemetic / PPIs. Hypernatremia in all the cases was managed with 5% Dextrose infusions.

Case 1 had resolution of hypernatremia and acidosis over 48 hours. She improved clinically and discharged on the 4th day after admission.

Four hours into admission, Case 2 worsened and was mechanically ventilated. He also had severe liver dysfunction (transaminitis). Regarding oliguria and acidosis, he was

Table 2. Clinical Features

Case	Age /Sex	Intention of poisoning	Time to Ingestion and arrival at ER	Symptoms/ signs at Presentation	Amount of compound Ingested	Initial Treatment Received
1	30 yr/F*	Suicidal	4 hours	Nausea,vomiting abdominal pain and restlessness BP -110/80mmhg, pulse rate-92bpm, spo2-98% on RA ^s irritable	50 ml	Gastric lavage /supportive therapy
2	32 yr/ M**	Suicidal	8 hours	vomiting and altered sensorium O/E- BP-120/80mmhg, PR -104bpm, oxygen saturation-90%on RA ^s , tachypneic, Comatose	200 ml	Gastric lavage /supportive therapy
3	48 yr/F*	Suicidal	2 hours	Nausea,vomiting,abdominal pain and altered sensorium O/E- BP-128/80, PR-92bpm, spo2-98% on RA ^s , disoriented	100ml	Gastric lavage /supportive therapy
4	35 yr/M**	Suicidal	5 hours	Nausea,vomiting ,and altered sensorium O/E- BP-128/80, PR-92bpm, spo2-98% on RA ^s irritable	100 ml	Gastric lavage /supportive therapy

*-Female, **- male \$- Room Air

Table 3. Laboratory Data on Admission

Case	1	2	3	4
Urea	60	104	50	16
Sr.Cr	1	2.2	1.8	0.97
NA	152	158	155	153
K	4.1	3.78	4.5	4
Alb	3.2	2.9	3.5	3.7
TB	1	0.9	1.2	0.94
AST	12	1143	20	24
ALT	14	900	25	18

Table 4. ABG on Admission

ABG-Case	1	2	3	4
Ph	7.3	7.48	7.2	7.31
pCO ₂	40	20.6	38	35.8
NA	150	154	154	152
K	3.5	3.78	3.5	3.65
Cl	109	118	116	113
HCO ₃	23.6	15.2	14	18
AG	13.4	20.8	24	21

planned for hemodialysis. Unfortunately, he succumbed before the dialysis initiated.

On the 2nd day of admission, Case 3 had a worsening of renal function and acidosis. However, she maintained a good urine output. She remained disoriented despite a partial correction of hypernatremia. She was taken up for hemodialysis owing to worsening acidosis. She saw dramatic improvement in her clinical status, acidosis, and hypernatremia resolved. She did not require any additional hemodialysis sessions. Her renal function improved and she was discharged on the 6th day after admission.

Case 4 was clinically better, oriented the next morning of admission. His hypernatremia and acidosis resolved over the next 48 hours. He had mild hypokalemia which resolved with oral potassium supplements. He was discharged on the 5th day after admission.

It should be noted that all the patients in this case report had no sequelae (renal dysfunction/ dyselectrolytemia / neurological) during 1 month of follow up.

DISCUSSION

This investigation, to the best of our knowledge, is the first case series of 2-4-D, Sodium Salt poisoning reported. Hypernatremia and high anion gap acidosis are the classical features of this type of poisoning, the severity of which varies with the ingested amount. Although we could not exactly determine the amount of poison ingested, we made a conclusion that the more severe cases tended to ingest

significantly more quantity of the compound. Hypernatremia and acidosis are explained by the high sodium and acid (80%) content in the compound ingested. The overall presence of high anion gap acidosis, even in the absence of renal failure, likens the behavior of this compound which is in turn similar to some of the toxic alcohols (methanol, ethyl alcohol).

The patient, who succumbed, had multiorgan failure, signifying the seriousness of the poisoning.

Two of the three cases, who survived, were managed conservatively by the correction of hypernatremia with dextrose infusions and other supportive measures. One of the patients developed a worsening of renal function and acidosis and was dialysed. The patient drastically improved with the correction of acidosis and hypernatremia after a single session of dialysis, and did not require any further dialysis. The drastic improvement may just be related to the correction of acidosis and hypernatremia by hemodialysis itself or may be hypothesized that the compound itself is dialyzable. The dramatic improvement and the behavior of the compound similar to a toxic alcohol, gives some support to the above hypothesis. It needs to be confirmed, in future cases whether dialysis has a similar effect or not. Also, it needs to be examined, whether early intervention with dialysis prevents morbidity and mortality of this poisoning.

Finally, as reported in previous case reports of successful utilization of urinary alkalisation in poisoning due to similar compounds, it needs to be seen if it is helpful in this particular compound.

CONCLUSION

Acute poisoning with 2-4-D, Sodium Salt causes significant clinical effects in adults including hypernatremia, high anion gap acidosis, AKI, and multiorgan failure. It is a life threatening emergency. Early diagnosis, optimal emergency management, and timely renal replacement therapy can improve the outcome of a patient with such a poisoning. It is also worth noting that though the package inserts mention to treat with Quinidine sulphate to control myotonia or suppress abnormal ventricular cardiac rhythm, none of the above patients developed this complication. Also none of the complications observed in the above case series were mentioned in the package insert, highlighting the need to update and caution people against using this pesticide.

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