

Paramedic Evidenced Based Practice
Critically Appraised Topic

Title: Aluminum Phosphide Poisonings and the use of Sodium Bicarbonate and Magnesium Sulphate

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Clinical Scenario: You arrive to a patient, approximately 50 years old laying in a bed. Family tells you that he has been feeling depressed and has had thought of suicide. A family member tells you that he has taken 3 of these tablets, and holds up the container to show you. It appears to be a grey tablet canister with the words "Aluminum Phosphide" along the side.

The patient states that he took them 20 minutes prior to calling EHS and states that he is having chest discomfort, nausea, abdominal pain and shortness of breathe. As you load him into the ambulance, you are noting the patient is becoming increasingly worse, his SPO2 is decreasing, his pulse rate is going down and he is constantly burping and it smells like metal/fish. You notice that he is having arrhythmias and once you get the patient to the hospital--> the patients pH is abnormal.

Backstory: The reason I decided to research this topic was that about 1.5 years ago, I actually did this call. Our patient had returned from India about 1 week prior and family stated that he had been feeling depressed and suicidal due to chronic pain. Family had stated that while he was on his trip to India, he obtained a container of Aluminum Phosphide. When he returned, he decided that he would take a few of these in an attempt to kill himself. What I did not know at the time is that this is a common way of suicide in India, Iran and many other countries. My partner and I had never heard of this, nor did we know the side effects or just how deadly this poison was. We loaded the patient onto our stretcher and

headed to the hospital which was only a few blocks away. I noticed that while we were on the way, my patient began to worsen and when we arrived at the hospital, he went into cardiac arrest. From onset of when he took the tablets to when he ultimately passed away was very quick. I decided to do some more research on the topic as I found it interesting and how taking Aluminum Phosphide can affect one's body and if there is a treatment option. I found that when AIP is exposed to moisture, it emits phosphine gas. It's colourless, gives off an odour of decaying fish/garlic and extremely flammable. This gas can disrupt myocardial contractility and can lead to arrhythmia's, metabolic acidosis and renal failure. It can also cause altered magnesium levels and a fluid shift/loss which can lead to hypernatremia.

PICO Question: Would patient survival rates increase in those who receive early sodium bicarbonate and magnesium sulphate with EHS after ingesting aluminum phosphide than those who receive it in the hospital.

Search Strategy/Outcomes:

(aluminum phosphide poisoning- 305 results)

(aluminum phosphide poisoning and sodium bicarbonate- 17 results)

(aluminum phosphide poisoning and sodium bicarbonate and magnesium sulphate- 8 results)

(aluminum phosphide poisoning and treatment- 160 results)

Studies:

1. 7 year study on aluminum phosphide poisoning in Tehran
2. 9 year study on aluminum phosphide poisoning in Saudi Arabia

Study #1:

Article: S, Shadnia. G, Sasanian. P, Allami. A, Hosseini (2009)

Population: All patients admitted and hospitalized during a period of 7 years from January 2000 to January 2007. There was a total of 471 patients that data was collected from.

Design: Retrospective Study→ I would say its a Level 2 Study

Outcomes: They collected data from 471 people who were admitted to the hospital. They collected and analyzed the gender, race, amount of Aluminum Phosphide (AIP), route of exposure, time between exposure and onset of signs & symptoms as well as attempted treatment. Overall, it looks like that the outcomes that they were indeed looking for was a variety of things. As there is no actual treatment for this type of poison overdose, they were looking to see what did/did not work in regards to patient mortality

Results: The study shows that of the 471 patients that were admitted with AIP poisoning, 50% of them were men. Most patients were between 20-40 years of age and self poisoning was observed in 93% of them. The fatality rate was at 31% with 146 of them dying. The average ingested dose was 5.1 grams and most of the patients took between 1-3 tablets. They noted a wide variety of signs and symptoms but the most common was gastrointestinal→ vomiting and cardiovascular manifestations, shown in 78.12% of patients. Poisoning was more common in the spring with 34% and winter at 24%. They attempted gastric lavage with potassium and administered calcium gluconate, magnesium sulphate, sodium bicarbonate and charcoal for most patients. They noted that the mean arterial blood pH was 7.23 and sodium bicarbonate levels were 12.7 mEq/L. It's important to note that a normal pH is between 7.35-7.40 and sodium bicarbonate levels are between 135-145 mEq/L. They stated that 100% of patents whose pH were below 7 died and 100% of patents with a pH over 7.35 survived. Electrocardiogram abnormalities were

noted in 65.5% of cases. Overall, they stated that there was a significant difference between survival and non-survival according to pH, HCO₃ concentration and ECG abnormalities.

Strengths & Weakness: I found that some strengths were that they had a high population amount and grouping. They took the time to also get some good data regarding the amounts of AIP taken as well as the outcomes. Some of the weakness were that there was no standards for management for the poisoning and they did not change the dosing of sodium or magnesium for those who had ingested higher amounts of AIP. They also state that in the study, it had some limitations including those that who had attempted suicide but were not brought to the hospital or those who avoided seeking treatment because of personal reasons—> fear of the stigma. It also did not include those that were referred to their local health clinics and renters and treated there. They did not include how many patients called EHS prior to arrival at the ER or how many were brought in by EHS.

Overall, I think they spent a good amount of time and gathered a wide variety of evidence and randomized patients to contribute to this study. I liked how they spent 7 years doing this study as to get as much information as they could.

Study #2

Article: S. Alnasser, S. Hussain, T. Kirdi & A. Ahmed (2018).

Population: All patients admitted and hospitalized during a period of 9 years between March 2006 to December 2017. There was a total of 68 patients that data was collected from.

Design: Retrospective Medical Record Review from Government Hospitals→ I'd say its a Level 2 Study

Outcome: They wanted to collect aggregated data, summary statistics and statistical comparisons. They wanted to collect data from patient records that contained different socio-economic variables and the different outcomes.

Results: The study shows that of the 68 patients that came into the hospital for aluminum phosphide poisoning, 53 had phosphine gas exposure during fumigation, 5 had topical exposure and the route was unknown in the other 10. There was no cases that were reported as intentional and that the range of tablets used was between 1-8. There were reported 38 (56%) were woman and 30 were male. 50% were non Saudi Arabian. The mean age was 18.6 years. It was also noted that 22 (82%) of the patient's that died we're all under the age if 20 years old. It seems that the mortality in the younger population was greater than that of adults ($P=0.043$). It was also noted that mortality was highest in those under the age of 7 years old ($P=0.006$). Of the 68 patients who were admitted, 22 (32%) died and those deaths occurred within the first 36 hours. 46 (68%) survived and were discharged. It seems all the patients had common signs and symptoms, being nausea, vomiting, metabolic acidosis (82%) hemodynamic instability (82%) and abdominal pain (64%). They state in their study that even though there is no antidote is available, treatment was only supportive. This included gastric lavage with activated charcoal. There was no mention of any use of sodium bicarbonate and magnesium sulphate.

Strengths & Weaknesses: I found that this study had a lot more weaknesses than the first study. I found that even though the study is over 9 years, they only had 68 patients in the study. It looks like they collected the data from multiple hospitals, so I am wondering why that number is so low. Do they have a lower rate of exposure or did they miss data. Especially considering that the first study was 2 years shorter and had way more patients. Overall, it was a very small sample size. It also lacked the data regarding routes of exposure. There were 10 patients who had no record of how they managed to come into contact with AIP. There is also a lack of information on when the patient got seen and to the time of treatment. It seems that they left out data from non-government hospitals, as they only took the data from government hospitals. I also wonder how many patients took AIP but never reported it to authorities or how many suicides were due to AIP. Overall, while this study is informative, I found it slightly underwhelming with regards to data collection and information.

Comments: Overall I found this research critically appraised topic very interesting and informative. I did find it interesting that there were very few papers and articles on aluminum phosphide poisoning and the use of sodium bicarbonate and magnesium sulphate. There were only a handful of papers that even used these on patients, and there was a wide range of results.

Consider: I would not change practice right now with regards to this topic as I don't think there has been enough concrete evidence to prove that it would work. That being said, I really think there should be a trial or something within Canada or the USA and get the results from that. I found that there was no trials/evidence anywhere then from outside the middle east.

I know that BCAS uses atropine for organophosphate poisonings and it would be interesting to see how BCAS and the rest of the world can help these patients who are using aluminum phosphide as a way of suicide. It has become an increasingly devastating and traumatic way to kill oneself.

REFERENCES

S Shadnia, G Sasanian, P Allami, A Hosseini, A Ranjbar, N Amini-Shirazi and M Abdollahi “*A retrospective 7-years study of aluminum phosphide poisoning in Tehran: Opportunities for Prevention*”. *Human & Experimental Toxicology* (2009) 28: 209–213

Alnasser S, Hussain SM, Kirdi TS, Ahmed A. Aluminum phosphide poisoning in Saudi Arabia over a nine-year period. *Ann Saudi Med* 2018; 38(4): 277-283. DOI: 10.5144/0256-4947.2018.277