# Hemolytic Uremic Syndrome Following the Aluminum Phosphide Poisoning: A Case Report

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**Abstract-** Aluminum Phosphide (ALP) is an effective, cheap, and highly toxic pesticide. ALP poisoning can have destructive effects on the human body, such as the heart, lungs, gastrointestinal tract, kidneys, and central nervous system, although all organs can be involved. We describe a 53-year-old Iranian Kurdish man with Hemolytic Uremic Syndrome (HUS) and Acute Kidney Injury (AKI). Supportive treatments such as hemodialysis and plasmapheresis were performed. After 23 days of hospitalization, the patient fully recovered and was discharged. Thrombotic microangiopathy such as HUS should be considered in patients with ALP toxicity that has a genetic defect in complement proteins. Combined use of hemodialysis and plasmapheresis improve outcomes in these patients.



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**Keywords:** Aluminum phosphide poisoning; Hemolytic uremic syndrome; Acute kidney injury

## Introduction

ALP is an effective pesticide agent used to protect cereal crops from pests and rodents in Iran and developing countries due to its low cost, high impact, and easy accessibility (1). Self-poisoning with ALP tablets increased over recent years in developing countries such as Iran (1,2). Mortality rates in ALP poisoning have been reported to be between 30% to 100% (3). Death is most often caused by shock and arrhythmia within the first 12-24 hours, and after 24 hours it may be due to renal kidney failure or other complications (4). Diffuse intravascular coagulation (DIC), shock, and acute tubular necrosis (ATN) are the most common cause of kidney failure in patients with ALP poisoning (5). ALP poisoning can affect different parts of the body and also causes lesser-known manifestations, including DIC, pancreatitis, rhabdomyolysis, and ATN (6). Uremic hemolytic syndrome is a clinical syndrome that presents with hemolytic anemia, thrombocytopenia, and renal failure (7). Platelet accumulation and thrombus formation in renal microcirculation lead to vascular ischemia and kidney failure (8). There is no specific antidote for ALP poisoning and the treatments are mainly supportive (9). Based on the previous studies, some supportive treatments such as sodium bicarbonate, hydrocortisone, Vit E, Vit C, magnesium sulfate, calcium gluconate, digoxin, glucagon, N-acetyl cysteine have been recommended for the treatment of rice pill poisoning. Also, based on the patient's condition and the hospital facilities, some measures such as dialysis, plasmapheresis and intra-aortic balloon pump may be used to treat the patients. However, none of these procedure have led to the survival of all aluminum phosphide poisoning cases (4,10). The aim of this study was to evaluate a rare case of HUS in 53 years old male who attempted suicide with a tablet of ALP.

## Case Report

A 53-year-old Kurdish man has been admitted in the emergency department of Mostafa Khomeini hospital located in Ilam, southwest of Iran, about half an hour after ingestion of one tablet of ALP. He had a history of

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hepatitis C and beta-thalassemia minor diseases and had recently been treated with alprazolam and fluoxetine tablets due to major depression. On arrival, the patient had nausea, vomiting, and abdominal pain. His vital signs were as follows: Blood pressure=130/90 mm/Hg, T=37° C, RR=15 breaths/m, PR=113 beats/m, GCS=15/15, SpO2=97% in room air. His Arterial Blood Gas (ABG) analysis and Electrocardiogram were normal. The patient was treated with Magnesium sulfate (1g q6h), Calcium Gluconate (1g q6h), 100 mg intravenous hydrocortisone (100 mg intravenous initial dose), *N*-acetylcysteine (NAC)/ oral (1 g q8h), Vitamin C (400 mg/day) and Vitamin E (400 mg/day). On the second day of admission, the patient's nausea and vomiting worsened, urine output decreased, and serum Creatinine level increased. However, Liver function tests (LFTs) were normal, and he had no neurological manifestations.

Nephrology consultation was performed, and ultrasound showed that the right kidney size was 105mm and the left kidney 118 mm. The echogenicity of the renal parenchyma was increased, but hydronephrosis and renal stone were not observed. On the fourth day after admission, serum, Creatinine increased again (Cr=9 mg/dl). The patient had a decrease in hemoglobin. Thus, he was visited by a hematologist for better evaluation. Due to the rise in serum Creatinine, an emergency surgical consultation was performed, and the catheter was inserted in the subclavian vein; the patient underwent hemodialysis for 2 hours. The decrease in hemoglobin level continued the fifth and sixth days after admission, so two units of whole blood were transfused to the patient. The following laboratory tests were conducted: Coombs direct/indirect=negative, Bilirubin total 2.22 mg/dl, Bilirubin direct 0.5 mg/dl. Peripheral blood smear (PBS) was indicative of more than two Schistocytes per high-powered visual field. A diagnosis of suspected hemolytic anemia was made based on the above laboratory test findings and clinical evaluation. The patient was treated with intravenous Dexamethasone (4 mg q12h), Folic acid (5 mg q12h), and oral Ciprofloxacin (250 mg q12h). He did not show any neurological symptoms and signs throughout hospitalization.

On the seven$^{th}$ day, the following tests were requested. The results showed low c3 and anti-double-stranded deoxyribonucleic acid (anti-dsDNA) levels. Anti-neutrophil cytoplasmic antibody (ANCA):C=0.1, ANCA. *P*=0.2 (12-18U/ML), dsDNA-Anti (ELISA)=6(16-24). U/ML, 50% Haemolytic Complement (CH50)/ELISA=57% (51-150), The third component of complement(C3)/(ELISA)=0.86(0.89-1.87 g/l), C4(EIA)=0.2012 (0.165-0.380 g/l), C-reactive protein (CRP)=negative, Anti-Nuclear Antibody (ANA)/(ELISA)=0.2(0.8-1.2) U/ML, Glucose 6-phosphate dehydrogenase (G6PD)=sufficient. Daily hemodialysis was performed due to the increased course of serum Creatinine. The patient was receiving nine units of Fresh Frozen Plasma (FFP) and four hemodialysis sessions performed from the fourth to the 23rd day of admission. On the eighth day of admission, platelet count rapidly decreased. According to the clinical presentations and laboratory findings, the patient was diagnosed with HUS. A cardiologist and infectious disease specialist for better evaluation visited the patient. Echocardiography was performed for the patient that showed normal results. There was no sign of fever, urinary and pulmonary infection, joint symptoms, tachypnea, tachycardia, or skin rashes, so the acute infectious process was ruled out. Due to the presence of thrombocytopenia, an increase in lactate dehydrogenase (LDH) level to 2446 u/l, and serum Creatinine raised, therapeutic plasmapheresis was conducted for three sessions, which eventually hemoglobin and platelet counts returned to normal after plasmapheresis. On the 23rd day, the patient was discharged from the hospital. Two months after discharge, the patient was referred to the nephrology clinic for a follow-up visit, where serum Creatinine was 1.4 mg/dl. The patient's laboratory findings are presented in table 1.

**Table 1. Patient's laboratory tests findings during hospitalization**

| Laboratory tests | Day 1 | Day 2 | Day 4 | Day 5 | Day 10 | Day 20 | Day 23 |
|---|---|---|---|---|---|---|---|
| **WBC,µl** | $6.1*10^3$ | $11.4*10^3$ | $6.8*10^3$ | $8*10^3$ | $12.4*10^3$ | $8.6*10^3$ | $6.2*10^3$ |
| **HB, gr/dl** | 10.3 | 9.7 | 8.2 | 6.5 | 8.6 | 8.1 | 8.5 |
| **PLT,µl** | $171*10^3$ | $261*10^3$ | $223*10^3$ | $239*10^3$ | $46*10^3$ | $139*10^3$ | $152*10^3$ |
| **BUN, mg/dl** | 20 | 62 | 171 | 247 | 217 | 47 | 21 |
| **Cr, mg/dl** | 0.95 | 2.44 | 9 | 7.79 | 8.35 | 1.73 | 1.56 |
| **LDH, U/L** | 193 | 2446 | 1819 | 1908 | 2112 | 870 | 468 |

## Discussion

The occurrence of HUS is very rare after ALP poisoning. HUS is a microvascular disorder that commonly occurs in infant children and is characterized by thrombocytopenia, hemolytic anemia, and renal

failure (11). 90% of these cases of HUS associated with diarrhea (12). About 10% of cases of HUS are known as atypical HUS or none Shigella toxin HUS (Stx-HUS) that are not associated with diarrhea (12,13). The annual incidence of noneStx-HUS is 2 cases per million adult populations that generally have a poor prognosis and lead to kidney failure in 50% of cases (11). In addition, 65% of these patients died from renal failure in the first year after the onset of the disease (11). This disease is most often caused by uncontrolled complement activity (14). Deficiencies in complement proteins can lead to cellular damage, which can initiate the blood-clotting cascade and cause thrombosis that, in the majority, C3 mutation-activating factor (as part of complement 3) can be caused HUS (14). Usually, in 70% of cases, an accelerating factor in genetically susceptible individuals causes atypical HUS (7). In this patient's anti-dsDNA antibody level and a C3 level lower than the normal range, it seems that the ALP tablet has acted as a trigger to cause a HUS. Initially, the patient developed a decrease in hemoglobin and increased serum Creatinine that, according to the patient's needs, hemodialysis was performed and units of blood transfused. Finally, the patient developed severe thrombocytopenia that received plasma treatment. However, due to no response to treatment, the patient underwent plasmapheresis and was discharged from the hospital in good general condition after three sessions of plasmapheresis.

HUS is more likely to occur in patients with ALP poisoning who have a genetic background of complement deficiency. Early diagnosis and timely treatment are necessary to prevent severe kidney damage.

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