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Toxic leukoencephalopathy in a young male caused by complex poisoning of laundry detergent *'Prinso'* and 2-Methyl-4-chlorophenoxyacetic acid

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Introduction

Oxalic acid and potassium permanganate ($KMnO_4$) are the main chemicals available in laundry detergent *'Prinso.'* Both of the above chemicals have corrosive effects on gastrointestinal mucosa leading to life threatening complications. Oxalic acid is known to cause many complications including haemorrhagic gastritis and esophageal perforation.

Though it is a legally banned product, in several areas in Sri Lanka including southern province, *Prinso* is still been locally produced and used as a detergent. Moreover, it is being used for deliberate self-harm. 2-Methyl-4-chlorophenoxyacetic acid (MCPA) is a chlorophenoxy herbicide which is commonly used in agriculture-based communities in Sri Lanka and hence it is widely accessible. There are several case reports which demonstrate toxic effects of oxalic acid and $KMnO_4$ (1, 2). But there are only limited numbers of case reports in the literature on the effects of MCPA poisoning. Combined ingestion of above three chemicals (oxalic acid, $KMnO_4$ and MCPA) has not been reported in the literature.

Although multiple systems get affected by above poisons, acute renal failure, gastrointestinal irritation, corrosive effects and neurological sequelae including confusion and seizures are the most common shared toxic manifestations. But leukoencephalopathy is not described as a complication.

We report a case of toxin induced leukoenceph--alopathy following intentional self-ingestion of toxic laundry detergent *'Prinso'* and MCPA in a young male.

Case presentation

A 21-year-old previously healthy mechanist admitted to our unit with vomiting, burning sensation in throat and epigastric pain for one day duration. Relatives have found that he had self-ingested MCPA (herbicide) with one sachet of white color *Prinso* and one sachet of black color *Prinso* (laundry detergent- two sachets each containing oxalic acid and potassium permanganate separately) about twenty-four hours before the admission.

On admission, he was conscious, rational and well oriented in time, place and person. He was haemodynamically stable. His cardiac, respiratory, abdominal and neurological examination findings were normal. His oral examination revealed erythematous and swollen tongue and lips. His cheeks had patchy erythematous areas.

After the admission, the patient had persistent vomiting, dysphagia, severe epigastric pain, shortness of breath, anuria, generalised oedema, impaired consciousness and several episodes of tonic clonic seizures. He had elevated blood pressure (180/100 mmHg), acidotic breathing pattern, generalized oedema, marked drop of oxygen saturation (SpO_2 80%) and bilateral fine basal crepitations in the lungs.

His initial laboratory work-up including blood sugar, haematology, renal and liver functions were normal. Urine full analysis showed 10 - 15 pus cells/hpt, moderately field full red cells and eight unclassified crystals. Creatine kinase was 440 U/L. Corrected serum calcium was low (0.7 mmol/L). Serum magnesium (0.84 mmol/L) was within normal range. Serum phosphate was high (2.99 mmol/L). Follow up serum creatinine and blood urea were rising gradually up to 11.2 mg/dL and 274 mg/dL respectively. Serum potassium rose up to 6.5 mmol/L. Creatine kinase was rising up to 3000 U/L. Follow up urine analysis was positive for red cells (7948), pus cells (71), there was proteinuria of 3+ and haemoglobin of 3+, leukocyte esterase was positive (2+) bacteria were positive and nitrates were negative. Urine culture was positive for coliform species. Serum albumin was 28 g/dL. Twenty-four-hour urine protein quantification was 1.5 g/dL. Albumin corrected calcium was 9.2 mg/dL. His serum amylase was within normal range.

Arterial blood gas showed metabolic acidosis with partial respiratory compensation with severe hypoxaemia (type one respiratory failure). Chest radiograph showed cardiomegaly, bilateral small pleural effusions, and bilateral hilar congestion with upper lobe diversion. Echocardiogram showed dilated left ventricle with global hypokinesia (ejection fraction was 40% - 45%) possibly due to myocarditis. Ultrasound abdomen showed bilateral swollen kidneys with increased cortical echogenicity and preserved cortico-medullary demarcation indicating acute renal parenchymal disease.

We evaluated for persistent drowsiness, and seizures. His inflammatory markers including C-reactive protein and erythrocyte sedimentation ratio were 43 mg/dL and 20 mm/1st hour respectively. Cerebrospinal fluid analysis and culture were normal. Electroencephalogram showed moderate to severe degree encephalopathy. His brain imaging with non-contrast brain at the beginning was unremarkable. A MRI scan of brain was performed on the 12th day of admission and there were symmetrical confluent white matter abnormalities in both cerebral hemispheres mainly in frontal, parietal and occipital region (Figure 1). Cerebellum and brain stem showed normal signal characteristics. With above findings the radiological conclusion was leukoencephalopathy.

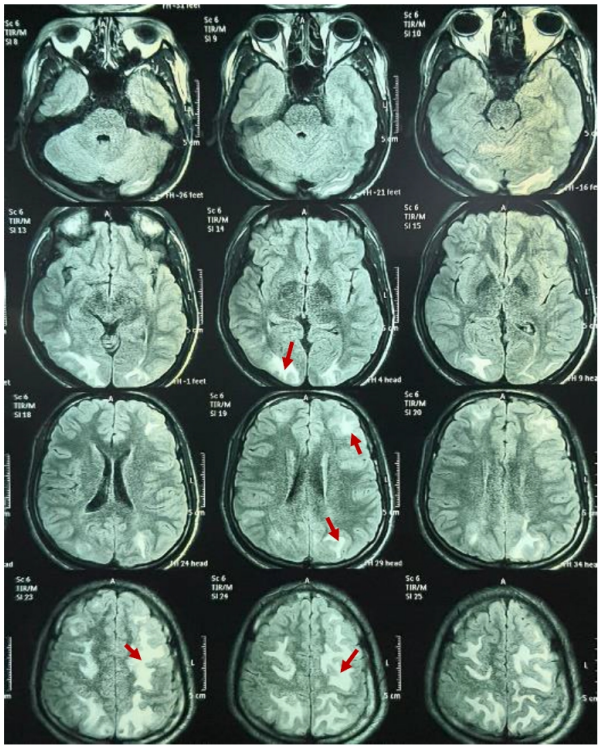

Figure1: FLAIR (Fluid alternated inversion recovery) image of MRI brain showing frontal-parieto-occipital white matter abnormalities (red arrows)

As this is a corrosive substance poisoning, routine decontamination procedures were not undertaken. On admission, patient's airway, breathing and circulation were stable. Initially, he had vomiting, burning sensation in throat and epigastric pain so we managed him with IV antiemetic (ondansetron 8 mg) and IV proton pump inhibitors (pantoprazole 40mg), plenty of milk was given to relieve the symptoms. Upper GI endoscopy did not show esophageal perforations or major peptic ulcers but there was severe esophagitis. Seizures were initially managed with IV midazolam, IV phenytoin. He was not responding to treatment and progressed into status epilepsy. He was having severe hypocalcaemia and was managed with multiple doses of IV 10% calcium gluconate, calcium carbonate via nasogastric tube until the normal calcium level was established. After stabilization, he was started on sodium valproate.

Patient developed acute kidney impairment which was complicated with metabolic acidosis, uraemia

severe hyperkalemia and nephrogenic pulmonary oedema. Emergency management with cardiac monitoring and hyperkalemia correction were implemented. Urgent renal replacement therapy was arranged and had continued for several occasions. Hypoxaemia was treated with oxygen via face mask and noninvasive ventilation with continuous positive airway pressure (CPAP). In spite of management patient had severe pulmonary oedema and type 1 respiratory failure. Electively intubation was done and ICU care was given. The patient was managed in the ICU for five days. Continuous cardiac monitoring was done but there were no significant arrhythmias. Optimum heart failure regime was implemented with: aspirin 75 mg, atorvastatin 40 mg, bisoprolol 5 mg, frusemide 80mg, spironolactone 25 mg and enalapril 5 mg. Follow up echocardiography performed after one week time showed no deterioration.

Other aetiologies for leukoencephalopathy-like, retroviral viral infection was excluded (Type 1 and 2 antibody were negative).

After liaising with the neurology team, we came to a conclusion that patient is having toxin-induced leukoencephalopathy, which was confirmed with electroencephalogram. Once the toxin was removed from the body with haemodialysis, seizures and drowsiness resolved.

Patient was managed in-ward for thirty days. During the hospital stay, he developed coliform positive urosepsis which we managed with IV meropenem 500 mg 8 hourly. We liaised with the psychiatric team in view of addressing depression and problem-solving counselling and was discharged after arranging the follow up.

Discussion

The detergent ingested by the patient, *Prinso* is marketed in two types of sachets; black colour and white colour containing potassium permanganate 1.2 g ($KMnO_4$) and oxalic acid 12.5 g respectively.

Our patient has simultaneously ingested both compounds combined with a well-known herbicide (MCPA). Oxalic acid is poorly absorbed from gastrointestinal tract and has a very low the bioavailability (2% - 5%). Excretion is mainly via the kidney. Lethal dose ranges from 15 g - 30 g but very small amount like 5 g can be fatal (3). Our patient had ingested one sachet containing 12.5 g of oxalic acid and a e sachet containing 1.2 g of $KMnO_4$. Oxalic acid is inherently corrosive to eyes, skin, and gastrointestinal tract (2). They are commonly used in manufacturing inks, dyes, bleaches, metal cleaners and laundry detergent powder. Oxalate combines with calcium and insoluble calcium oxalate is formed. Calcium oxalate crystals deposit in proximal tubules of kidneys. Therefore, there will be serum hypocalcaemia with systemic manifestations.

Major mechanisms of renal toxicity are due to the local necrosis of tubular epithelium and obstruction of renal tubules by the crystals which lead to renal dysfunction and electrolyte disturbance (4).

Presentation after oxalic acid ingestion can be with burning sensation, oedema and ulceration of mouth and pharynx and difficulty in swallowing. They will end up with haemorrhagic gastritis. Shock, acute renal failure, convulsions and coma are the features of severe toxicity. Urine will contain albumin, red cells, white blood cells and oxalate crystals. The renal biopsy findings reported with oxalic acid poisoning are acute tubulo-interstitial nephritis (2).

$KMnO_4$ is a widely used disinfectant which is applied to skin lesions such as eczematous dermatitis and used as a laundry detergent powder. It is a water-soluble violet crystal. It is also a corrosive and causes a coagulative type tissue necrosis. Average lethal dose is 10 g. Presentation due to ingestion of $KMnO_4$ is nausea, vomiting, burning sensation of mouth, chest pain and abdominal pain due to the corrosive effect. Some of the patients may manifest as stridor, cough, and difficulty in breathing as a consequence of necrosis of oropharyngeal mucosa and perforation of esophagus. Severe poisoning will be manifest with shock, jaundice, renal failure and methemo--globinaemia.

Our patient had severe renal impairment. Unfortunately, we could not arrange for renal biopsy due to the unstable condition of the patient. In our patient, though cardiovascular manifestations like QT prolongation did not occur he had recurrent seizures in the first few days until normocalcaemia was achieved.

Chlorophenoxy compounds are group of herbicides in various forms, concentrations and combinations. There are several commercially available products such as 2, 4-D (2, 4-dichloropheenoxyacetic acid), 2, 4-DP (2, 4-dichlorophenoxypropionic acid), 2, 4-DB (2, 4-dichlorophenoxybutyric acid), 2, 4, 5-T (2, 4, 5 trichlorophenoxyacetic acid), MCPP (*Mecoprop*). Many of the cases reported are due to 2, 4-D and *Mecoprop* poisoning. But almost all chlorophenoxy herbicides share their toxic effects and hence the clinical sequelae (5).

Absorption of chlorophenoxy compounds is basically via the gastrointestinal tract but absorption from lungs and skin is minimal. Excretion is via kidneys. Half-life depends on the fat solubility, the chemical arrangement of the methyl, acetic and chloride groups into the benzene ring and the urinary pH. Excretion is greatly increased in alkaline pH. Severity of symptoms and signs depend on the amount of MCPA which is ingested. Majority of MCPA self-poisoning patients (85%) have only mild gastrointestinal symptoms (7).

Spectrum of presentation is from mild gastro--intestinal symptoms to fatal outcomes such as renal failure, severe metabolic acidosis, electrolyte imbalance and multiple organ failure (5, 6).

Large quantity ingestion will lead to severe muscle toxicity such as myotonia, muscle weakness, myoglobinuria, elevated creatine phosphokinase due to striated muscle damage. Muscle damage will manifest as metabolic acidosis, hyperkalemia and hypocalcaemia. Cardiac changes observed are hypotension, tachycardia and T wave flattening (5, 6). Neurological changes can also associate with MCPA poisoning such as mental status change, confusion, moderate cerebral edema, and bizarre behavior to coma (7). Our patient had developed hyperkalemia, hypocalcaemia, high creatine phosphokinase and acute renal impairment as sequelae of rhabdomyolysis. Neurological manifestations also developed in our patient such as confusion, seizures, behavioral changes and leukoencephalopathy.

Toxin induced leukoencephalopathy has been reported with heroin, chemotherapeutic drugs such as methotrexate (8). But the literature does not a single case with leukoencephalopathy following ingestion of oxalic acid, $KMnO_4$ or MCPA, as in our patinet.

In our case scenario with combined complex toxin ingestion, we expected to have clinical manifestations due to toxin interaction other than individual manifestations related to individual toxin. As both 'MCPA' and *'Prinso'* are nephrotoxic chemicals, here the renal toxicity might have been exaggerated with the combined ingestion.

Informed consent was obtained from the patient to publish this case report with pictures.

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