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Rhabdomyolysis due to hair dye poisoning: An emerging threat

Krishnaswamy Sampathkumar, Yesudas Santhakumari Sooraj,
Rajappannair Prabha Ajeshkumar, Amol Ramesh Mahaldar, Ramakrishnan Muthiah

Abstract

Rhabdomyolysis can be caused by a variety of physical, chemical, metabolic, infective and toxic causes. We present two patients who developed rhabdomyolysis after consumption of hair dye containing paraphenylene diamine. Both of them developed renal, liver and respiratory failure requiring renal replacement. We were able to save one patient whereas the other died. Intentional hair dye poisoning is an emerging threat. Early recognition of the complications and prompt treatment is necessary for a successful outcome.

Key words: Acute renal failure, hair dye, rhabdomyolysis

Introduction

Rhabdomyolysis can develop due to physical (heat stroke), chemical (drugs, poisons), metabolic (Hypokalemia) and infective (Leptospirosis, Dengue virus) causes. We report an unusual cause of chemical poisoning leading leading to muscle injury and acute renal failure.

Supervasmol 33^R is a commonly used hair dye in India. The active ingredients include paraphenylene diamine (PPD), propylene glycol, liquid paraffin, cetostearyl alcohol, sodium lauryl sulphate and resorcinol. Ingestion of 100 ml of the dye on suicidal intent can lead to severe complications like laryngeal edema, acute renal failure (ARF) and rhabdomyolysis. We present two cases of hair dye ingestion who presented to our department.

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Case Report

Two young women presented to our department with intentional supervasmol 33 ingestion. The baseline features are given in Table 1. The investigative abnormalities are given in Table 2. Both of them developed respiratory distress and required endotracheal intubation. Both had severe metabolic acidosis and severe renal failure. The first patient also had evidence of acute respiratory alkalosis due to hyperventilation as a result of the pain and

Table 1: Characteristics of individual patients

	Patient 1	Patient 2
Age	23	19
Sex	Female	Female
Time of presentation (days after consumption)	Third day	Third day
Respiratory stridor due to laryngospasm	yes	yes
Metabolic acidosis	yes	yes
+ Respiratory Alkalosis		yes
pH=7.46.		p H=7.36
S.Bicarb=16.		S.Bicarb= 16.1.
pCO2 =23		pCO2 = 29
Acute renal failure	yes	yes
Rhabdomyolysis	yes	yes
Liver injury	yes	yes
Coagulation abnormalities	yes	yes
Dialysis	Hemodialysis	CAVH
Days of hospital stay	2	7
Recovered	Died	yes

Table 2: Biochemical values of individual patients

	Patient 1	Patient 2
Hemoglobin gm/dl	11.6	10.6
Urea mg/dl	87	132
Creatinine mg/dl	3.8	5.5
Potassium mEq/L	6.3	4.1
Creatinine Phosphokinase IU/L	172825	121851
T Protein/Albumin gms/dl	5.4/1.8	6.9/3.4
SGOT/SGPT IU/L	1501/1633	3051/596
Calcium mg/dl	8.5	8.1
Phosphorus mg/dl	6.5	7.6
Uric Acid mg/dl	7.6	8.5

inflammation of the oropharynx. Creatine phosphokinase levels were grossly elevated in both indicating severe rhabdomyolysis and both had evidence of renal injury. Both were initially treated with sodium bicarbonate infusion and Frusemide. Both required renal replacement therapy in the form of hemodialysis in the first case and continuous arterio venous hemofiltration (CAVH) in the second case due to hemodynamic instability. CAVH was chosen in the second patient in view of the non-availability of a Continuous Renal Replacement Therapy machine in our set-up to perform CVVH. Unfortunately only one of them could be saved.

Discussion

Hair dye ingestion leading to a wide variety of complications has been described in literature. Supravasmol 33 is a widely used hair dye in India. It has a potent nephrotoxic cocktail containing paraphenylene diamine (PPD), propylene glycol and resorcinol. Poisoning with PPD presents with the characteristic features of severe angioneurotic edema, rhabdomyolysis and intravascular hemolysis with hemoglobinuria culminating in acute renal failure.^[1] Kallel *et al.*, studied 19 patients with PPD intoxication in Tunisia over a six-year period. Clinical symptoms were dominated by cervicofacial edema (79%), chocolate-brown colored urine (74%), upper airway tract edema (68.4%), oliguria (36.8%), muscular edema (26.3%) and shock (26.3%). Rhabdomyolysis and metabolic acidosis were seen in all the patients. ARF was seen in 47.4% and hyperkalemia in 26.3%.^[2] The mechanism of rhabdomyolysis has been investigated in rats by Yabe K.^[3] PPD can bring about rhabdomyolysis by promoting calcium release and leakage of calcium ions from the smooth endoplasmic reticulum, followed by continuous contraction and irreversible change in the muscle's structure.^[3] Rhabdomyolysis is the main cause of acute renal failure and the morbidity and mortality are high once renal failure develops. Hypovolemia and

the direct toxic effects of PPD or its metabolites on the kidneys also contribute. Histologic changes of acute tubular necrosis have been described in PPD poisoning.^[4] The respiratory syndrome following the ingestion of PPD is represented by asphyxia and respiratory failure secondary to inflammatory edema involving cricopharynx and larynx.^[2] Myoglobinuric ARF is observed in the tropics after a variety of conditions, such as crush syndrome, burns, heat stroke, electrical injury, eclampsia, prolonged labour, poisoning with mercuric chloride, zinc or aluminum phosphide, status epilepticus, viral myositis and status asthmaticus.^[5] The diagnosis is established by the demonstration of myoglobin in urine and elevated levels of creatine phosphokinase and aldolase in the serum. Since myoglobin is a small molecule with a molecular weight of 17 kDa and binds only lightly to the plasma proteins, it escapes easily in the urine. Therefore, the urine may not contain myoglobin if the patient presents late in the course of the disease and the true incidence of myoglobinuric ARF will be underestimated. Severe hypocalcaemia and hyperuricaemia during the oliguric phase and hypercalcaemia during the diuretic phase are characteristic of this condition.^[5] The pathogenesis of myoglobinuric ARF is similar to that following intravascular hemolysis. Renal histology shows acute tubular necrosis. Early recognition of Rhabdomyolysis is crucial since intravenous bicarbonate and saline have been shown to ameliorate the development of Acute Renal failure in crush injuries.

Propylene glycol is a viscous, colorless liquid commonly used as a solvent. It is associated with hyperosmolality, raised anion gap metabolic acidosis, central nervous system depression, arrhythmias and less commonly renal dysfunction.^[6] Acute tubular necrosis has been described.^[6] Proximal renal tubular cell swelling and vacuole formation have also been seen in propylene glycol ingestion.^[7] Di- and polyethylene glycols have been used as cheap substitutes of propylene glycol as vehicles in paediatric syrup preparations. An epidemic of diethylene glycol (DEG)-induced ARF was first reported in the 1930s amongst children in the United States who consumed sulfanilamide elixir contaminated with DEG. This prompted the passage of US Food, Drugs and Cosmetics Act in 1938, following which there has been only one report of this kind from a Western country. This contamination continues to occur in tropical countries and epidemics have been reported from many regions

including India, Bangladesh, Nigeria, South Africa and Haiti. Fourteen patients died of ARF following administration of a preparation of glycerol to lower intracranial or intraocular pressures. Analysis of this preparation showed it to be 70% ethylene glycol. Renal histology at autopsy revealed acute cortical necrosis as the most frequent lesion. In other reports, several children have been affected after consuming contaminated paracetamol syrup. In one large study, 236 deaths were recorded amongst 339 children with unexplained ARF in a Children's hospital in Dhaka (Bangladesh). A total of 51 of these children were documented to have ingested a brand of paracetamol known to contain DEG, whereas 85 per cent of the remaining patients had ingested an unknown elixir for fever.^[6]

But the characteristic features of rhabdomyolysis and laryngeal edema which typifies PPD poisoning is absent.

Resorcinol is a phenol derivative. Being a phenol it has also been postulated to cause renal failure.

Conclusion

Hair dye ingestion is an uncommon cause of attempted suicide in India. It consists of a number of nephrotoxic chemicals. It can lead to respiratory, musculoskeletal and renal manifestations. An early recognition and prompt treatment can lead to reduction in the incidence

of rhabdomyolysis and renal failure.

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