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Case Report OMICS International

Para Phenylene Diamine Poisoning: Hepatic and Renal Damage

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Abstract

Suicide is the second leading cause of death and it kills one person in every 40 seconds mostly between age limits 15-29 years. The global official surveys conducted reported higher death rates in low and middle income countries; however, women were affected more than men. Poisoning with chemicals is known to be a preferred method of suicide. The morbidity and mortality data following hair dye poisoning peaked in last few years. Interestingly, poisoning with Para Phenylene Diamine (PPD) is an emerging way of intentional self-harm in developing countries of Asia and Africa. We report here a case of 15 years old patient brought to our hospital emergency unit. The patient developed sudden onset of acute cervico-facial edema, lacrimation and abdominal pain, later followed by deranged liver and renal functions progressing towards liver and renal failure. The history selectively indicated the ingestion of a hair dye locally called "Kala Pathar" which predominantly contains PPD. The lack of specific diagnostic tests, a specific antidote for PPD poison and the importance of early supportive treatment are discussed.

Keywords: Para phenylene diamine; Hair dye; Poisonous; Ingestion; Kala pathar; Liver failure; Renal failure; Hemodialysis

Introduction

The World Health Organization (WHO) reported higher death rates and suicidal attempts among youngsters in low and middle income countries [1]. It is worth mentioning that women were affected more than men [2,3]. A locally used hair dye called "Kala Pathar" was found to contain a poisonous chemical identified as Para Phenylene Diamine (PPD) which showed several side effects including multiple organ injury and cancer [4,5]. Earlier reports also suggested that PPD on ingestion or inhalation caused a serious triad of cervico-facial edema, rhabdomylasis leading to acute renal failure and acute hepatic failure [6,7]. PPD is used as an intermediate in manufacture of antioxidants and as accelerators for rubbers [7,8]. PPD is widely used as a dye prepared by mixing it with Henna for giving it much darker color [8-11].

In fact, PPD is a coal-tar derivative which on oxidation by cytochrome P450-peroxidase produces Brondrowski's base having allergenic, mutagenic and highly toxic properties. PPD behaves like an allergen and causes mast cell degranulation, capillary leaking, anaphylactic reactions and cellular damage mainly hepatocytes. Nausea, vomiting, dysphagia and facial edema occurs following ingestion of poison. PPD is rapidly absorbed through mucous membranes after its oral intake, and metabolized into quinonediimine, which acts as a cytotoxin. It is acetylatedinto N-acetyl-PPD and N,N-diacetyl-PPD as the major metabolites for detoxification to be excreted into urine [12,13]. PPD obtained from different sources is also known to cause fatal injuries to vital organs leading to death [14-18]. In our earlier study, PPD was found to be used in majority suicidal attempts in the rural areas of D.I. Khan City, Pakistan [19]. In continuation of our work a PPD poisoning, a recent case is presented in the current communication.

Case Report

A 18 years old girl presented to the medical emergency department on 27 November, 2014 at 9:10 pm with history of ingestion of Vasmol containing PPD hair dye around 7:00 pm. The patient was complaining of severe abdominal pain, difficulty in breathing and 2 episodes of black colored vomiting. On inquiry, it was revealed that she was native of a near-by village. The patient history confirmed that she lost her mother and quarreled with her step mother. After the fight, she hurriedly went to a room and took poison for suicidal purpose intentionally. On examination there was severe cervico-facial edema, swollen tongue, lacrimation and redness of eyes. Her vitals were: R/R 25/min, Pulse 110/min, BP 90/80 mm Hg, and she was afebrile. Rest of the systemic examination was unremarkable. At the time of arrival to the emergency room routine blood and urine samples were collected. The laboratory investigations showed ALT 68 u/l, Blood Urea 58 mg/dl, Serum Creatinine 1.9 mg/dl, Hemoglobin 12.9 gm/dl.

She was resuscitated and symptomatic treatment to secure her airway and circulation was given. PPD poisoning is known to involve different organs, hence, measures to facilitate breathing are taken [3,19]. On day 3, she had deranged blood chemistry with ALT value ranging between 800-900 u/l, AST 507 u/l, Total Serum Bilirubin (TBIL) 52 µmol/L (normal: 1.7 to 20 µmol/L), with PT 25 sec, and a PTT>1 min. The renal profile increased with Urea 88 mg/dl and Creatinine 6.2 mg/dl. On the 5th day, she developed swelling of limbs, periorbital edema and generalized petachiae. She went into oliguria state Perioheral smear showed schistocyets, a feature of intravascular hemolysis. Laboratory investigations showed ALT of 1500 u/l, PT>30 sec, APTT>1 min, AST 804 u/l. The observed hepatotoxicity might be

attributed to the allergic and mutagenic potential of PDD reported by earlier researchers [15].

The renal profile peaked with Urea and Creatinine of 220 mg/dl and 9.8 mg/dl respectively. Urine examination showed albinuria and haemoglobinuria. She also showed feature of metabolic acidosis on arterial analysis and serum electrolytes showed hyperkalemia and hyponatremia. Our findings on the renal toxicity are substantiated by the earlier reports on PDD toxicity where PDD induced glomerulosclerosis was confirmed by renal biopsy [20,21]. During the present investigations the toxic manifestations were further confirmed by Ultrasonography which revealed reduced size of kidneys with hepatic enlargement [22]. Prolonged use of PDD is known to induce cancer due to the mutagenicity of PDD and its metabolites [23].

The patient was managed conservatively on the treatment of hepatic and renal failure with diuretics, fluids, antibiotics, soda bicarbonates. She was also referred to Nephrology Unit for hemodialysis. The liver profile was monitored to look for improvement in functions. The patient slowly improved with treatment and the measures introduced. Based on the popular use of Kala Pathar hair dye containing predominantly toxic chemical PDD, a public awareness campaign is suggested to highlight the side effect of this hair dye and to discourage its use.

Summary

Para phenylene diamine is a toxic and hazardous material which is commonly available in each house in the developing countries. Unfortunately, both ladies as well as men use it as hair dye because it is much cheaper than other hair dyes available in the market. It is worth mentioning that suicide attempts with Kala Pathar are well established public health problem which warrants an expensive awareness campaign in the country.

The WHO and several other reports defined hepatic failure induced by PDD were due to its severe allergic and mutagenic nature [9,15]. The PDD is oxidized by cytochrome P450 peroxidase and formed derivatives cause the damage. PDD is well classified under poisons which on oral ingestion might cause necrosis of hepatocytes initiating the release of alanine aminotransferase. Secondary to hepatocyte necrosis liver production of clotting factors are disturbed, hence, PT and APTT are prolonged and generalized petachiae occur. On the other side, the renal failure observed is a combined consequence of Rhabdomyalsis and accumulation free radicals and detoxification of metabolites in renal tubules [13].

The common clinical features of PDD poisoning are: nausea, vomiting, abdominal pain, cervico-facial edema, lacrimation, redness of eyes and swollen tongue as confirmed, existing in the patient under discussion. Late onset complications are renal function derangement and compromised liver functions.

There is no single antidote for PPD poison [4]. Symptomatic treatment with IV fluids, steroids, alkalinizing agents and antiallergics is effective in relieving initial symptoms. Emergency tracheostomy shows effective results in abutting cervical edema and securing airway. Hepatic and renal failures were treated by controlled monitoring of vitals, intake/output charting, alkalinizing agents, potassium and sodium correction, oral L-ornithine supplements for hepatic failure and more aggressive steps like hemodialysis.

Conclusion

Early presentation to the health providers is the most significant factor as the latent period for the development of these symptoms is 30 minutes to one and half hour.

The management option of immense importance is emergency tracheostomy [3,13]. Forced and alkaline diuresis using furosemide and soda bicarbonate is necessary for protecting renal tissues as the poison is highly acidic and needs alkalization for its removal through renal tissues. In cases of acute renal failure patient should be put on hemodialysis. Cases with deranged liver functions tests are managed using supportive hepatoprotective medicines like L-ornithines. Awareness and psychiatric counseling among patients has a vital role in reducing mortality among younger age group individuals.

Declaration

The authors have nothing to declare as conflict of interest with the industry, institution or any person. The study was conducted mainly for academic reasons.

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