

## Research Article

# Study of hair dye poisoning and its outcome in tertiary care rural institute

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## ABSTRACT

**Background:** Hair dye poisoning is not rare but is an emerging poisoning in India. The main component of hair dye causing toxicity is para phenylene diamine (PPD). Due to its easy availability and low cost, it is becoming a common mode of self-poisoning in rural area. A prospective study was planned to assess the clinical profile and outcome in patients with hair dye poisoning.

**Methods:** This prospective observational study was conducted on 260 patients of para-phenylene-diamine (hair dye) poisoning, hospitalized in the medical unit of UP Rural Institute of Medical Science and Research, Saifai from January 2011-2014 over a period of 4 years. The diagnosis of PPD poisoning was based on history of ingestion and clinical manifestations. All cases were thoroughly evaluated for different complications and were treated accordingly.

**Results:** Out of 260 cases enrolled, majority were females and were in the age group of 21-30 years. The intent of poisoning was suicidal in 100% cases. Cervico-facial edema was the most common presentation followed by respiratory distress, hypotension and generalised bodyache. Nephro-toxicity was observed in 58.46% cases. Myocarditis was observed in 11.53% cases. Mortality in PPD poisoning was high (21.53%) due to cardiotoxicity and renal failure

**Conclusions:** Hair dye (PPD) poisoning is hepato-nephro as well as myo and cardiotoxic.

**Keywords:** Hair dye poisoning, Paraphenylene diamine, Cervico-facial edema, Myocarditis

## INTRODUCTION

Hair dye poisoning is not rare but is an emerging poisoning in India. The main component of hair dye causing toxicity is paraphenylene-diamine (PPD).<sup>1</sup> Acute poisoning by PPD causes characteristic severe angioedema of the upper airway accompanied by a swollen, dry, hard, and protruding tongue. Systemic intoxication results in multisystem involvement and can damage the respiratory, muscular, renal and hepatic system and cause death.<sup>2</sup> PPD consumption is an uncommon cause of acute kidney injury (AKI). There is no specific antidote for PPD and treatment is mainly supportive.

This study was initiated to assess some of the factors that lead to hair dye intoxication, determine symptoms and signs, management, complications, outcome of hair dye poisoning and assess the relationship between the type of intoxication in relation with age, gender, route of administration and outcome.

## METHODS

This prospective observational study was conducted on 260 patients of para-phenylene-diamine (hair dye) poisoning, hospitalized in the medical unit of UP Rural Institute of Medical Science and Research, Saifai from January 2011-2014 over a period of 4 years.

A detailed clinical history was recorded including demographic profile (name, age, sex, marital status), type of hair dye consumed, intention of poisoning, time interval between consumption of poison and first medical attention, nature of symptoms and clinical examination. The diagnosis of PPD poisoning was based on history of ingestion and clinical manifestations. All the patients were thoroughly examined, investigated and managed conservatively. Till date there is no definite management guidelines. All the patients in our study were managed on the basis of following principles adopted by P K Jain et al.

As there is no specific antidote for PPD, so the management was basically supportive. Gastric lavage with activated charcoal. Oxygen was administered if SpO<sub>2</sub> was <90%, proven hypoxia by ABG analysis and in severe angioedema.

Intravenous corticosteroids (hydrocortisone/methylprednisolone) for angioneurotic edema was the main stay of treatment. Chlorpheniramine maleate was also used for 3-5 days. Vasopressors (dopamine/noradrenaline) were used if hypotension persists even after adequate fluid therapy.

Forced alkaline diuresis (sodabcarb along with loop diuretics) to prevent myoglobin mediated tubular injury.

Hemodialysis was done whenever required in cases of renal failure, metabolic acidosis and hyperkalaemia.

## RESULTS

Total number of cases enrolled in our study was 260, out of them 160 (61.54%) were females and 100 (38.46%) were males. Maximum number of patients (46.15%) were in age group of 21-30 years with majority of them married (69.23%) (Table 1). The intent of the poisoning was suicidal and by oral route in 100% of cases (Table 2). Majority of the patients (78.46%) consumed local stone based hair dye (Table 3). About 38.46% of the patients were brought to hospital emergency within 6 hours, about 30.77% after 6 hours and only 10 patients (7.69%) were brought within 2 hours of ingestion of poisoning (Table 4). Patients who reached hospital emergency (first medical attention) early were better managed with less morbidity and mortality.

The clinical presentation of patients was proportionately associated with the amount and the type of dye consumed. Ingestion of stone based (local preparation) was associated with serious systemic and local complications. Super vasmol type hair dye consumption showed only biochemical changes especially mild derangement of SGPT/SGOT while Godrej and other preparations were non-toxic. The cervico-facial swelling was the most common symptom (70.76%) involving tongue, floor of mouth, eyelids and conjunctiva which

may be due to prolonged time of contact with oropharyngeal mucosa (Table 5).

**Table 1: Demographic profile of patients.**

Parameter	No. of patients	Percentage
<b>Age</b>		
0-10	0	0
11-20	100	38.46
21-30	120	46.15
31-40	20	7.69
41-50	10	3.85
>51	10	3.85
<b>Sex</b>		
Male	100	38.46
Female	160	61.54
<b>Marital status</b>		
Unmarried	80	30.77
Married	180	69.23

**Table 2: Distribution of patients according to intent and route of poisoning.**

Intent of poisoning	No. of patients	Percentage
Suicidal	260	100
Accidental	0	0
Homicidal	0	0
Intent not known	0	0
<b>Route of poisoning</b>		
Oral	260	100
Inhalation	0	0
Percutaneous	0	0

**Table 3: Comparison between systemic toxicity of different hair dye preparation containing ppd.**

Type of dye consumed	No. of patients	%	Toxicity profile (hepatonephro-myotonic)
Local PPD mixed (stone base) hair dye	204	78.46	yes
Godrej and other preparation	44	16.92	absent
Super vasmol 32	12	4.6	±

The next common presentation was predominantly respiratory distress, hypotension, generalized bodyache and muscle weakness with minimal cervico-facial swelling.

**Table 4: Distribution of patients according to interval between ingestion of poison and first medical attention.**

Duration	No. of patients	Percentage
Within 2 hrs	20	7.69
Within 6 hrs	60	23.07
More than 6 hrs	180	69.23

**Table 5: Clinical symptoms.**

Symptoms	No. of patients	Percentage
Cervicofacial swelling	184	70.76
Difficulty in breathing	180	69.23
Decreased urine output	140	53.84
Generalised bodyache with muscle weakness	160	61.53
Chocolate brown colour urine	152	58.4598

Such patients had history of immediate swallowing of large amount of hair dye and developed features suggestive of myocarditis immediately and later on. 11.53% cases showed non-specific ECG changes like sinus tachycardia, diffuse ST depression and T wave inversion. On the basis of clinical features and ECG changes, these patients had strong suspicion of

myocarditis, out of which 4.6% patients expired. In our study, 3 patients developed ventricular tachycardia (2 at time of admission and 1 patient during therapy) and expired despite adequate available treatment at our centre.

**Table 6: Physical signs observed in PPD poisoning.**

Signs	No. of patients	Percentage
Tachypnea (rr>18/min)	164	63.76
Tachycardia (hr>100/min)	184	70.76
decreased air entry due to laryngeal edema	104	40
Cyanosis	30	11.53
Hypotension	26	10
Bilateral basal crepitations	50	19.23

Serum bilirubin was raised in 12.3% cases and SGPT/SGOT levels were raised in approximately 50% cases (Table 7). This concludes that rise in SGOT was not only because of liver necrosis but also inflict muscle injury. SGOT was higher than SGPT which further supports the above statement. Serum alkaline phosphatase was raised in 9.23% cases suggestive of cholestasis and hepatic injury.

**Table 7: Investigations at time of admission in PPD poisoning.**

Investigations	Increased		Normal range		
	Value normal	No. of patients	%	No. of patients	%
Leucocyte count	4000-11000	20	8.7	240	92.30
Liver profile					
Sgpt	<40 iu	136	52.30	-	-
Sgot	<40 iu	132	50.76	-	-
S. Bilirubin	<1mg%	32	12.30	-	-
S. Alkaline phosphatase	>120 iu	24	9.23	-	-
Renal profile					
S creatinine	<1.4mg%	152	58.46		
S. Na+	135-145 meq/l;	22↓	8.46		
S. K+	3.5-5 meq/l	28↑	18.46		
S. Ca++	9-10.5meq/l	8↓	3.07		
Urine					
Routine/microscopic esp for myoglobin	(myoglobin)	56	21.53		
Serum					
Cpk level	Upto>190	186	71.33		

Chocolate brown colour/ cola coloured urine was present in 58.45% cases especially in those who had prominent muscle pain, tenderness and cervico-facial swelling .It was due to presence of myoglobin and haemoglobin in urine. Muscle tenderness was more marked in thigh and

calf muscles. 53.84% cases showed decreased urine output. Multiple sessions of dialysis were required in these cases and had increased morbidity and mortality.

The main physical signs in our study were tachycardia, tachypnoea, decreased air entry, cyanosis and hypotension (Table 6).

In our study, serum creatinine levels were raised in 58.46% cases and 71.33% cases showed elevation of CPK (Table 7). Maximum elevation of CPK was upto 90000 and serum creatinine was raised upto 12 mg%. Majority of these cases landed in AKI for which multiple sessions of dialysis were required, leading to increased hospital stay, morbidity and mortality. The elevation of CPK was due to rhabdomyolysis, which was associated with increase in serum creatinine and BUN in majority of cases.

Electrolyte abnormality was reported in 30% cases, out of them 8.46% cases showed hyponatremia, 18.46% cases showed hyperkalemia and 3.07% cases had hypocalcemia (Table 7). Hyperkalemia was associated with increased mortality despite medical management and dialysis. In our study, 2 hypocalcemic patients manifested tetany, both of them had calcium level <7 mg%.

Thus it is concluded that Hair dye (PPD) poisoning is hepato-nephro as well as myo and cardiotoxic. Prolonged hospitalization was required in 73.84% cases. Mortality in PPD poisoning was high (21.53%) due to cardiotoxicity and renal failure (Table 8).

**Table 8: Outcome of PPD poisoning patients.**

Outcome	No. of PTS	%
Complications(prolonged hospitalization i.e. >7 days)	192	73.84
Mortality	Early <24 hors	6.15
	Late >24 hors	15.38
Favourable	12	4.6

## DISCUSSION

Para phenylene-diamine is a very potent poison employed for dyeing of hairs. It is very toxic to the human cells and also produces fatal effects on various organ by causing angio-neurotic edema, myocarditis and rhabdomyolysis. Due to its easy availability and low cost, it becomes a common mode of self-poisoning in rural area.

Peak incidence of PPD poisoning was between 21 to 30 years. This may be due to stress, social insecurity, unemployment and overall less maturity in this age group. Females were found to be more affected by hair dye intoxication. This is because females are subjected and exposed to PPD more than men due to cosmetic use of henna to enhance the blackening of hair and also it is used as a skin cosmetic. The married persons are more

vulnerable to poisoning due to social and family boundations or failure to meet with the desired goals of their lives. These findings are similar to the study conducted by Ayoub Filali et al and M Hamdouk et al.<sup>3,4</sup>

The intent of poisoning was suicidal in 100% case, however psychological evaluation was found to be normal in all these patients. This indicate that most of suicidal attempts were impulsive precipitated by either scolding from parents, family quarrels and socio-economic failure. In our study, all patients were exposed to hair dye through oral ingestion due to ease of administration. This was similar to that observed by P K Jain et al.<sup>5</sup>

The clinical presentation in our study was similar to Ashar A et al with cervico-facial edema as a commonest presentation. Sampath Kumar Krishnaswamy et al too reported the development of rhabdomyolysis with characteristic cola coloured urinr after consumption of hair dye containing PPD.<sup>6,7</sup>

The main physical signs in our study were tachycardia, tachypnoea, decreased air entry, cyanosis and hypotension. These findings were due to very high toxicity of PPD secondary to development of laryngeal edema, leading to decreased air entry, development of cyanosis, tachycaria and hypotension due to myocardial damage as evidenced by various ECG changes. The myocarditis due to hair dye poisoning has also been reported in various studies by P K Jain et, Brahmi N et al and Zeggwagh AA et al.<sup>5,8,9</sup>

Various biochemical investigations found PPD to be hepato-toxic. Saito K et al also reported high level of SGPT/SGOT in their study of hair dye poisoning. In our study, the overall incidence of renal failure was 58.46% while Abdelrheem MB et al showed renal failure in 71%.<sup>10,11</sup>

The moratlity rate in our study was 21.53% which is comparable to Ayoub Filali et al and Osman et al.<sup>3,12</sup>

## CONCLUSION

PPD containing hair dye is a great hazard and its use has been banned in countries like Germany, France and Sweden. However in India it is still commonly used in many parts and needs to be banned. It is important that medical fraternity should be aware of this poison because the poison is available quite freely and used extensively especially in rural areas. Public education and awareness of PPD related health hazards is urgently required so that PPD is used for “dyeing and not for dying”.

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