

## ORIGINAL ARTICLE

# Paraphenylene diamine poisoning: Our experience at PMC Hospital Nawabshah

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## ABSTRACT

**Objective:** The aim of this descriptive, case series study was to study demographics, clinical features and outcome of paraphenylene diamine (PPD) (commonly known by local people as 'kala pathar') poisoning admitted to our intensive care unit (ICU) from June 2009 and May 2012.

**Methodology:** All cases of PPD poisoning admitted to ICU of the Peoples Medical College Hospital, Nawabshah, between June 2009 and May 2012 were included in this study. Demographic features, clinical features and outcome of patients were recorded.

**Results:** A total of 16 poisoning cases were admitted to the ICU. The mean age was  $25.87 \pm 5.59$  years; a majority of the patients were young females (21-30 years) and belonged to a low socioeconomic class. The main cause was intentional suicidal ingestion. Cervicofacial edema, throat pain, dysphagia, dysphonia, and stridor were the earliest clinical findings. Rhabdomyolysis, hepatitis and acute renal failure dominated the clinical picture during the later course of poisoning. Active pharmacological intervention, elective tracheostomy and assisted ventilation were the therapeutic measures required for survival. A high mortality rate (37.5%) was observed in the study.

**Conclusion:** Paraphenylene diamine (PPD) poisoning is associated with high morbidity & mortality.

**Keywords:** Paraphenylene diamine poisoning; Cervicofacial edema

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## INTRODUCTION

Suicide is a preventable public health problem, resulting in one million fatalities every year worldwide, increasing by 60% over the last 50 years especially in developing countries.<sup>1</sup> Poisoning is a preferred method of suicide and is one of the major problems encountered in emergency departments of hospitals.<sup>2</sup> In the developed countries, an overdose of sedatives, hypnotics or narcotics is commonly employed to achieve it, whereas in developing countries agricultural pesticides are used.<sup>3-4</sup>

Poisoning with PPD is a new trend of intentional self harm in various developing countries of Asia and Africa,<sup>5</sup> and is associated with high mortality.<sup>6</sup> PPD is an active ingredient of 'Kala Pathar'. It is crushed and mixed with henna and used as hair dye or for enhancing the color of henna. Its use as a hair dye has been on an increase in our area. The compound PPD is highly toxic when taken orally and death occurred within the

first 6-24 hours due to angioneurotic edema or cardiotoxicity which lead to fatal arrhythmias.<sup>7</sup> Smaller doses, or if the patient vomits most of the dye, will usually present as angioneurotic edema and hepatitis. A moderate dose will cause acute renal failure within the first week.<sup>8</sup> Despite the high mortality and frequency of cases, no antidote is available for this poisoning<sup>8</sup> and is managed conservatively.

The aim of the study was to share our experiences regarding this chemical and to document the clinical presentation, laboratory findings, and outcomes of hair dye poisoning at ICU of Peoples Medical College Hospital (PMCH) Nawabshah.

## METHODOLOGY

This study was conducted at the 8-bedded ICU of PMC Hospital Nawabshah, a tertiary care hospital in Sindh

province of Pakistan, between July 2009 and June 2012. During this period a total of 16 patients with hair dye poisoning were admitted in the ICU through emergency and medical departments. The ethics committee of said institute has approved the study protocol for publishing the results.

In this study, a pro forma was used to collect data including demographic features (age, sex, marital status, socio economic status), clinical features (especially cervicofacial edema and color of urine), laboratory findings (complete blood count, liver function test, CK, LDH, glucose, urea, creatinine, electrolytes and ECG), mode of intoxication (accidental or suicide) and route of intoxication (gastrointestinal system, skin). The diagnosis of PPD poisoning was based on clinical findings and information taken from the patient's family and friends. Toxicology screening or postmortem could not be performed due to social restrictions. All patients received gastric lavage, antihistamines, parenteral steroids, sodium bicarbonate, dextrose and saline via IV. Forced diuresis was used to augment elimination of renally excreted toxins. Tracheostomies were performed in 10 patients because laryngeal edema made intubation impossible. Synchronized intermittent mandatory ventilation and pressure support mode (pressure-controlled or volume-controlled) were started. The positive end expiratory pressure was initially applied as 5 cm H<sub>2</sub>O and then titrated to keep O<sub>2</sub> saturation above 94%. Weaning for mechanical ventilation was carried out with pressure support weaning and T-tube trials. Hospitalization time, morbidity and mortality rates were also recorded. Attendants were counseled and recovered patients were referred to psychiatry department for psychiatric assessment.

Statistical analyzes was done by using SPSS for windows release 15 (SPSS) software. Continuous data were presented as mean and standard deviation, whereas categorical data were presented in numbers and percentages.

## RESULTS

Of the 16 patients admitted, 14(87.5%) were females and 2(12.5%) were males. The mean age was 25.87 ± 5.59 years and majority of the patients (68.8%) were 21-30 years of age. Suicidal intention was identified in 75% of the cases and 4(25%) were declared accidental. Social conflicts formed the basis of 80% of intoxications. All cases were from the rural areas. The poison was taken orally in 13(81.3%) cases and by transdermal route in 3(18.8%) cases. Demographic features are summarized in Table 1.

**Table 1: Demographic characteristics of the patients**

Parameter	Value*	
Age (Mean ± SD)	25.87 ± 5.59	
Gender	Male	02 12.5%
	Female	14 87.5%
Age (year)	12-20	03 18.8%
	21-30	11 68.8%
	31-40	02 12.5%
Marital status	Single	07 43.8%
	Married	09 56.3%
Economical status	High	01 00%
	Middle	01 6.3%
	Low	15 93.8%
Mode of intoxication	Suicidal	12 75%
	Accidental	04 25%
Mode of Transmission	Orally	13 81.3%
	Trans-dermal	03 18.8%

\*Data expressed as N(%) unless specified

**Table 2: Clinical Features and outcome of Kala Pathar poisoning**

Clinical Features	N (%)
Pain in Throat	16 (100)
Oral Erythema	16 (100)
Cervicofacial Edema	16 (100)
Dysphagia	16 (100)
Dysphonia	16 (100)
Difficulty in Opening of Mouth	16(100)
Muscle Aches/Rigidity	10 (62.5)
Dark urine	13 (81.3)
Rhabdomyolysis	09 (56.3)
Oliguria/Anuria	05 (31.3)
Acute Renal Failure	06 (37.5)
Hyperkalemia	03 (18.8)
Hepatitis	14 (87.5)
Hemodynamic shock	03 (18.8)
Sinus bradycardia	03 (18.8)
Sinus tachycardia	13 (81.3)
Outcome	N (%)
Tracheostomy	14 (87.5)
Ventilator	12 (75)
ICU stay (days)	6.43±3.61
Mortality	06 (37.5)

The clinical features of hair dye poisoning (pain in throat, oral erythema, cervicofacial edema, dysphagia and dysphonia) were present in all patients (100%).

Evidence of rhabdomyolysis (muscle aches/tenderness, muscle edema, cola-colored urine, raised creatinine phosphokinase, myoglobinuria) was present in 56.3% of the cases. Hemodynamic shock, sinus bradycardia and T-tenting were detectable in 18.8% while sinus tachycardia was noted in 81% of the patients. Oliguria/anuria was reported in 5(31.3%), while acute renal failure was inferred in 37.5% of the cases. Stridor was observed in 8(50%) cases (Table 2). Classical features of poisoning such as cervicofacial edema, dark-colored urine, and hepatitis were observed within six hours of poison intake. Regarding laboratory investigation, the mean  $\pm$  SD of TLC, SGPT and CPK was  $10375 \pm 4731.1$ ,  $851.19 \pm 1604$  and  $28.43 \pm 13.20$  respectively [Table 3].

**Table 3: Laboratory parameters**

Laboratory parameters	Mean $\pm$ SD	Mode/Range
TLC (1000 cells/mm <sup>3</sup> )	10375 $\pm$ 4731.1	6000/5000-20000
CPK (U/Lin 1000)	28.43 $\pm$ 13.20	24/1.00-60
SGOT (U/L)	1365.18 $\pm$ 1186.28	1500/119-5247
SGPT (U/L)	851.19 $\pm$ 1604	100/20-6550
Serum creatinine (mg/dL)	1.98 $\pm$ 2.97	1.00/0.50-13

During the hospital stay all patients received hydrocortisone, 14(87.5%) needed an emergency tracheotomy, 12(75%) patients required ventilator support for airway compromise and 2 patients (12.5%) developed acute renal failure (ARF) after 72 hours of poisoning. The mean ICU stay was  $5.76 \pm 3.05$  days (1–20). 6 (37.5%) patients expired out of a total of 16.

## DISCUSSION

PPD poisoning in the form of compound hair dye known as 'kala pathar' is emerging as a new trend in suicidal poisoning in our setting because of easy availability, low cost and salty taste rather than bitter. The constituents of 'kala pathar' include 4% PPD, resorcinol, propylene glycol, ethylenediaminetetraacetic acid (EDTA), sodium, liquid paraffin, cetostearyl alcohol, sodium lauryl sulphate, herbal extracts, preservatives, and perfumes.<sup>9</sup> Some of these are known toxins with systemic effects, while the toxicity profile of others is not known. The toxic effects depend on the dosage.<sup>10</sup>

Like many earlier studies, the majority of the patients in our study were young females ( $25.87 \pm 5.59$  years). Akber MH<sup>6</sup> and Anugrah Chrispal et al<sup>12</sup> identified similar age group with female predominance, 27.75 years and  $20.5 \pm 4.65$  years respectively. Social conflicts may be the reason of poisoning in this age group. All

of our patients belonged to rural area and low socio-economic status and the purpose of ingestion of this compound was suicidal in majority of cases (70%). It is usually ingested to threaten the family members if the demands are not met.

Classical features of poisoning occurred within four to six hours of ingestion. It is very crucial to reach appropriate health care facility within this time period, during which most of the deaths occur. Cervicofacial edema was the first symptom to develop as observed in studies by Anugrah Chrispal et al<sup>12</sup> (69.2%) and Kallel et al (79%),<sup>11</sup> but its exact cause remains unclear.<sup>12</sup> Respiratory failure is the main threat to life; endotracheal intubation, tracheostomy and assisted ventilation are crucial and lifesaving measures. Suliman et al<sup>11</sup> observed a tracheostomy rate of 15.8% in his patients, a study at Multan<sup>6</sup> showed this rate to be 60% while 87.5% of our patients required this procedure. This needs further explanation; the amount of poison ingested and the sample size may explain the difference. Coma/unconsciousness is another important feature of PPD poisoning which was observed in 6(37.5%) of our cases, while the figure was 20 and 26.3% in studies by Akber and Kallel et al.<sup>6,13</sup> Hypovolemia, sepsis and myocarditis might be the underlying cause. We observed hyperkalemia in 12.5% patients, which has been identified as one of the factors predictive of mortality due to PPD poisoning.<sup>14</sup> Hyperkalemia was noted to be 20% and 26.3% patients in the study by Kallel et al<sup>13</sup> and in a local study respectively.<sup>6</sup> Rhabdomyolysis and ARF may be cause of hyperkalemia. We observed 75% patients in our study had evidence for rhabdomyolysis, Kallel et al also noted rhabdomyolysis in all of patients in his study. ARF occurred in 37.5% of patients (47.4% by Kallel et al and 40 % by Akber et al).<sup>6, 13</sup> We also found that the markers of hepatitis were significantly higher in our patients, 40% in local study<sup>6</sup> and 100% in international study. Consumption of small amount of PPD, as low as 25ml results in hepatitis.<sup>8, 10</sup>

A study at Nellore India<sup>8</sup> showed that the increase in morbidity, e.g. need of ventilatory support, duration of hospital stay and mortality was dependant on the dose taken by the patient but we didn't record the actual amount consumed by the patients due to lack of sources. Most of these patients expired so we assumed that they had taken large doses of the poison. We observed a high mortality rate (68.8%) as compared to other studies, 20% at Multan,<sup>6</sup> 4% at India, 21% by Benslama et al.<sup>16</sup> This difference might be due to late recognition and late arrival of patients in our hospital. Therefore, early recognition and early arrival can be life saving. As there is no specific antidote, the management of poisoning includes gastric lavage, antihis-

tamines, parenteral steroids especially hydrocortisone, and alkalization of the urine.<sup>8</sup> Respiratory distress is the major early problem which may require ventilatory support. Renal support in the form of dialysis is required in acute renal failure,<sup>8</sup> but our patients did not need dialysis because they were not fit for dialysis and expired early.

## CONCLUSION

Paraphenylene diamine (PPD) (Kala Pathar) poisoning

could be a warning to the Asian countries and emerging as alternative to organophosphorus poisoning because of its easy availability, low cost and bitterness. We recommend public awareness regarding this toxin and sale of Kala Pathar should be legally restricted by government.

## DISCLOSURE

None of the authors received any financial benefit from any source while conducting this study.

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