

# Emerging Trend of Self Harm by Using 'Kala Pathar' Hair Dye (Paraphenylene diamine): An Epidemiological Study

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## ABSTRACT

**Background:** Poisoning due to Hair dye containing Paraphenylene diamine, famous with local name of 'Kala Pathar' is an emerging way of self harm in developing countries. The substance produces toxic effects if ingested or when applied locally including angioedema, respiratory distress, rhabdomyolysis, acute renal failure and hepatic necrosis. **Objective:** To study the demographic profile, clinical manifestations & outcome of the victims of 'Kala Pathar' hair dye (PPD) poisoning. **Study Design, Setting & Duration:** Prospective study was carried out in Bahawal Victoria Hospital, Bahawalpur (a tertiary care health institution) for the period from 1<sup>st</sup> January 2016 to 10<sup>th</sup> March 2016. **Methodology:** The study conducted in 109 patients of Paraphenylene diamine poisoning admitted in B.V. Hospital Bahawalpur, through Accident & Emergency Department with history of ingestion of Kala Pathar hair dye. The patients were treated conservatively & tracheostomy was done as life saving measure in all cases having acute cervicofacial and laryngeal oedema. The patients were grouped according to the age, gender, clinical presentation and final outcome. The data cleaned, analyzed and results were expressed in tables & charts. **Results:** Out of the total 109 patients, 12(11%) were male & 97(89%) females. Majority 91 (83.48%) victim belonged to the age range of 11-30 years involving 83(76.15%) females and 26(23.85%) males. One hundred & four (95.41%) patients were of lower socioeconomic class and rural dwellers. Suicidal intention was reported in all 109 (100%) cases who developed cervicofacial oedema associated with dyspnea & stridor and emergency tracheostomy was done in all those victims. Eighty Six(78.90%) patients were discharged in good condition and 23(21.10%) expired due to complications of Paraphenylene diamine poisoning. Of those 23 fatalities, 19(82.60%) were females & 4(17.40%) males. **Conclusion:** 'Kala Pathar' Paraphenylene diamine poisoning is more common in females of younger age group belonging to rural areas & associated with high mortality. The cases could be managed by early diagnosis and prompt actions for supportive treatment because no specific antidote is available. As burden of such cases has been increasing, there is dire need for bringing awareness among the public regarding the toxic effects of hair dye (PPD). It is suggested that sale of 'Kala Pathar' should be legally restricted by the concerned authorities.

**Key Words:** Kala Pathar, Paraphenylene diamine, Hair dyes, Suicide, Deliberate self-harm, Poisoning.

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## INTRODUCTION

More than one million fatalities occur every year throughout the world due to deliberate self harm, the trend increasing by 60% during last 50 years particularly in developing countries. About 60% of all reported suicides in the world may take place in Asia and 40% of all cases occur in China, India and Japan because of their large populations<sup>1</sup>. Among the preferred methods of self destruction, use of poison is one of the major problems encountered in emergency departments of many hospitals<sup>2</sup>. Intentional self poisoning causes the majority of deaths and put on the immense strain on

hospital services. The trend of self harm by ingestion of hair dye 'Kala Pathar' containing active ingredient Paraphenylene diamine is emerging in developing countries and associated with high mortality<sup>3</sup>. Paraphenylene diamine (PPD) is metabolised by electron oxidation to an active radical by cytochrome P450 peroxidase to form a reactive compound called benzoquinone diamine and it can be further oxidized to Brandowaski's base, which may lead to cause anaphylaxis. PPD is used as chemical ingredient in temporary tattoo ink as well as in fabrics, dark makeup, photocopying

inks, printing, products of the rubber and gasoline but its use as black henna for hair dye & tattoo ink is very common in India and North Africa.

Ingestion of (PPD) produces symptoms involving different organs which may include edema of the face, neck, pharynx, tongue and larynx initially and its poisoning can cause angioneurotic edema, rhabdomyolysis and acute renal failure. Renal tubular necrosis occurs due to deposits of the toxic metabolites of Paraphenylene diamine leading to high mortality rates<sup>4,5,6,7</sup> which have also been reported by some authors as 68.8%<sup>8</sup> and 60%<sup>21</sup>. The toxicity of Paraphenylene diamine is dose dependent with estimated lethal dose of 7–10 grams.<sup>9</sup>

Kala Pathar is crushed and mixed with henna and used as hair dye for enhancing its color. Being compound of highly toxic nature, Paraphenylene diamine exerts its effects on the muscular, respiratory, hepatic, renal and cardiac systems by inhibiting cellular oxidation. Its toxic effects are dependent upon the quantity of dose. When taken orally, death may occur within initial 6-24 hours due to angioneurotic edema<sup>10</sup>. Despite higher frequency of cases and high mortality, no antidote is available for this poison and the cases have to be managed conservatively<sup>11</sup>. An early diagnosis & supportive treatment could be helpful.

Cheap and freely available hair dyes are emerging as one of the major cause of suicidal poisoning in underdeveloped countries like India & Pakistan<sup>3,8,12</sup>

Majority of the reported cases involve young females with age range of 15 to 25 years<sup>13,15</sup>. Acute poisoning by Paraphenylene diamine, the major component of ‘Kala Pathar’ hair dye, produces severe angioneurotic edema of the upper airway accompanied by a swollen, hard and protruding tongue and may lead to cause stridor. Higher incidence of 70 to 80% leading to cervicofacial edema has been reported by few authors<sup>12,14,15</sup> and most of these patients required tracheotomy for management of airway obstruction<sup>16,17</sup>. Cardiotoxicity & hepatic necrosis due to Paraphenylene diamine have also been observed, but very few reports are available in literature about myocarditis,<sup>18,19</sup> acute myocardial infarction,<sup>20</sup> ventricular thrombosis and cardiac arrhythmias<sup>22</sup>.

The purpose of this work was to study the demographic profile of ‘Kala Pathar’ Hair dye poisoning cases & to share our experience on

clinical presentation and outcome of the victims of suicidal poisoning by using ‘Kala Pathar’ hair dye in urban as well as rural areas of District Bahawalpur.

## METHODOLOGY

This study was conducted in Accident & Emergency Department of B.V Hospital, a tertiary care health institution attached with Quaid-e-Azam Medical College, Bahawalpur Pakistan, for the period from 1<sup>st</sup> January, 2016 to 10<sup>th</sup> March, 2016. All cases of poisoning with the history of suicidal intake of ‘Kala Pathar’ (hair dye) brought to the emergency department, were studied in detail.

Clinical history, presenting complaints, physical examination, methods of treatment and outcome was also recorded. Gastric lavage was done in few patients whom it was possible. All patients of ‘Kala Pathar’ poisoning were treated with steroids whereas endotracheal intubation was attempted in few cases but in view of severe cervicofacial / laryngeal oedema, respiratory obstruction & life threatening condition; tracheostomy was performed in all cases. Forced diuresis was done to avoid acute renal shut down resulting due to rhabdomyolysis.

The cases of self harm by using the modalities i.e. firearm, hanging, drowning and accidental poisoning due to some other toxicant were not included. The victims were grouped according to the gender, age range, residential background, treatment and final outcome after hospital admission. The data was cleaned, analyzed and results obtained were expressed in tables & charts. Statistical analysis was done for interpretation of the results.

## RESULTS

Out of the total 109 cases affected by Kala Pathar (hair dye) poison, 97(89%) were females and 12(11%) males. (Table 1 & Fig.1)

**Table 1: Gender distribution among victims of Kala Pathar (PPD) Poisoning (n=109)**

Kala Pathar (Hair Dye) Paraphenylene diamine Poisoning		
No. of Cases		Total
Male	Female	
12 (11%)	97 (89%)	109

The majority of cases 55(50.45%) belonged to younger age group of 11-20 years followed by those

in 3<sup>rd</sup> and 4<sup>th</sup> decade of life 36(33.02%) & 12(11%) respectively whereas 6(4.50%) victims belonged to the age range of 41-60 years. (Table 2).

**Table 2: Involvement of age groups in victims of Kala Pathar (PPD) Poisoning (n=109)**

Age Groups (In Years)	No. of Cases	Percentage
11-20	55	50.45%
21-30	36	33.03%
31-40	12	11.01%
41-50	4	3.67%
51-60	2	1.84%
<b>Total</b>	<b>109</b>	<b>100%</b>

One hundred & four (95.41%) patients were of lower socioeconomic class & rural dwellers and 5(4.59%) were urban citizens. (Table 3).

**Table 3: Residential Background of the victims of Kala Pathar (PPD) Poisoning (n=109)**

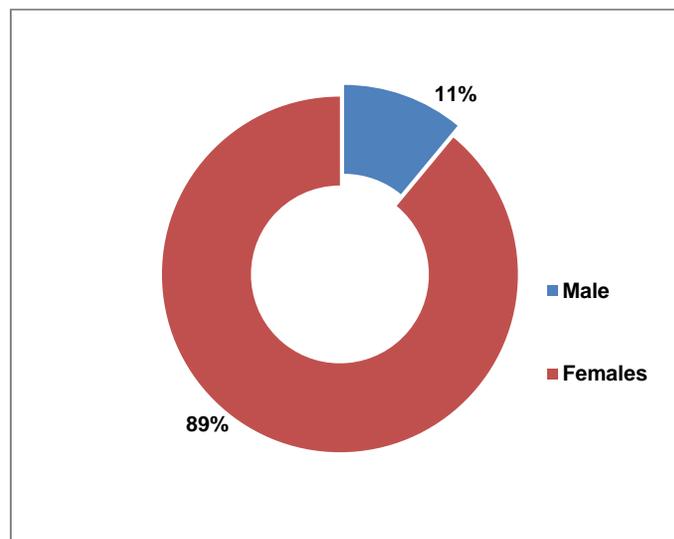
Kala Pathar (Hair Dye) Paraphenylenediamine Poisoning		
No. of Cases		Total
Rural	Urban	
104 (95.41%)	5 (4.59%)	109

Tendency to commit suicide was almost 100% involving all 109 cases involving both males and females. Majority of patients had burning & pain in mouth, throat and abdomen. All the victims of Kala Pathar poisoning developed angioneurotic edema, cervicofacial swelling, dyspnoea and stridor.

Burning & pain in oral cavity, throat and abdomen associated with vomiting were the earliest symptoms in almost all patients. Hypotension developed within six hours after the oral intake. Angioneurotic edema, dyspnoea and dark colored urine developed within 6 – 24 hours. Acute renal failure was dose dependent and observed in those who ingested more than 50 ml of dye. Eighty six (78.90%) patients were discharged from hospital in good health condition after conservative management and 23(21.10%) died due to complications like acute renal failure, Pneumonia, septicemia & shock. Of those 23 cases died of Paraphenylenediamine poisoning, 19(82.60%) were females and 4 (17.40%) males. (Table 4).

**Table 4: Final outcome of the victims of Kala Pathar (PPD) Poisoning (n=109)**

No. of Deaths		No. of patients Discharged in Good Condition
Male	Female	
4 (3.67%)	19 (17.43%)	86 (78.90%)



**Figure 1: Gender distribution among victims of Hair Dye (PPD) Poisoning (n=109)**

## DISCUSSION

Kala Pathar containing Paraphenylenediamine (PPD) a cheap & freely available hair dye is emerging as a major cause of suicidal poisoning in developing countries involving the people with low socioeconomic status and rural dwellers. It contains potential toxins including Paraphenylenediamine, sodium ethylene diamine tetra acetic acid and propylene glycol which can result in multiorgan dysfunction<sup>3</sup>. In our study, prevalence of self-harm by using PPD was more in the age range of 11–30 years with female preponderance of 89%. Similar age group with female predominance was noted by Akber et al<sup>3</sup> and Anugrah Chrispal et al<sup>4</sup>. Another study conducted by Sakuntala et al<sup>24</sup> reported involvement of 80.64% females and this preponderance of females with a male to female ratio of 1:1.84 has been documented by Nirmala and Ganesh et al<sup>25</sup>. This fact of female preponderance in Kala Pathar poisoning could be explained as a low cost and easy availability of this hair dye. In addition to that, females are more exposed to gender inequalities and social pressures in the developing countries. The patients developed

Cervicofacial edema with varying severity in our study within range of 3 – 6 hours. All 109 patients developed severe angioneurotic edema / strider, acute respiratory obstruction and emergency tracheostomy was done in those 109(100%) patients. Tracheostomy rate of 60% has been documented in a study at Multan<sup>3</sup> and 87.5% in Nawabshah<sup>8</sup> but 100% of our patients required this procedure being the life saving measure.

Mortality was 21.10% in our study, and comparable with other studies conducted by Akbar et al<sup>3</sup> at Multan which was 20% and Khuhro et al<sup>8</sup> documented the mortality of 37.5% among the patients in their study at Nawabshah whereas 22.48% mortality has been reported by Jain PK et al<sup>22</sup> in a study conducted at Jhansi-India upon 1595 patients of hair dye poisoning. Another study conducted by KN et al<sup>23</sup> at Dera Ismail Khan noted the mortality rate 47.4% in patients of PPD hair dye poisoning.

## CONCLUSION

The clinical profile of hair dye ingestion is dominated by development of angioneurotic edema Rhabdomyolysis and acute kidney injury. Antihistamines, steroids, hydration along with diuresis were the methods of choice for managing such cases. Management of the air ways in the form of tracheostomy or endotracheal intubation, dialysis for acute renal failure were the modalities for treating complications.

As there is no specific antidote for hair dye poisoning and burden of cases has been increasing, there is need for bringing awareness among the public regarding the toxic effects of this hair dye. General physicians & intensive care physicians need to be aware of its clinical manifestations & management. One should be vigilant of the anticipated complications and be prompt in instituting good supportive management to minimize the morbidity and mortality. It is suggested that sale of Kala Pathar should be legally restricted by government.

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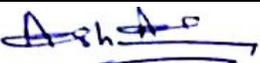
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Dr. Aslam Baig	Collection of data, Tabulation of results, Proof reading	
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