

# Epidemic of *Kala Pathar* (Paraphenylene Diamine) Poisoning: an Emerging Threat in Southern Punjab

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## ABSTRACT

**Objective:** To assess cases of the spectrum of *Kala Pathar* poisoning in all age groups.

**Study Design:** Cross-sectional study.

**Place and Duration of Study:** Combined Military Hospital (CMH) Bahawalpur and Bahawal Victoria Hospital (BVH), Bahawalpur, from January 2016 to April 2017.

**Methodology:** All the cases of *Kala Pathar* (Paraphenylene diamine (PPD)) poisoning, admitted and treated at the study places during said period were included in the study. The assessed variable included gender, age, education status, socioeconomic status, reason of poisoning and mortality. Chi-square was applied for qualitative variables with p-value less than 0.05 was considered significant.

**Results:** A total of 1,258 cases of PPD poisoning were included in the study; 814 (64.7%) females and 444 (35.3%) males. Their age ranged from 5 - 63 years, with median age 21 (IQR 4). Sixty-six (5.2%) were children and the rest 1,192 (94.8%) were adults. In adults 1,125 (94.37%) cases of PPD poisoning were suicidal and 62 (5.20%) accidental cases; only 5 (0.42%) adults were intentionally poisoned. On the other hand, only one child took it with suicidal intent, 54 (81.81%) ingested it accidentally and 11 (16.66%) children were given poison deliberately with the intent to murder. The overall mortality was 24.08% – 22.81% in adults, and 46.96% in children.

**Conclusion:** *Kala Pathar* (PPD) is a lethal substance when ingested. PPD poisoning is not limited to adults; many cases of pediatric poisoning are also being reported in Southern Punjab. Mortality due to *Kala Pathar* is high. Tracheostomy should be done immediately in all such cases; and high intensive multidisciplinary approach is required.

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

## INTRODUCTION

According to World Health Organization (WHO), the incidence of suicide is increasing every year, making it a public health concern.<sup>1</sup> Most common way for this deliberate self-harm is poisoning. Lack of knowledge about the toxicity of available poisons and paucity of medical services lead to high mortality in developing countries.<sup>2</sup> In Pakistan, although pesticide poisoning remains the leading cause, but poisoning with paraphenylene diamine (PPD), locally known as '*Kala Pathar*', is emerging as important means of intentional self-harm.<sup>3-5</sup>

*Kala Pathar* (black stone) is a low-cost and readily available hair dye in Pakistan. Its chemical ingredient PPD is a toxic and lethal substance when ingested.<sup>6</sup>

PPD is a coal tar derivative, used as hair dyeing agent after mixing with hydrogen peroxide and ammonia. It is also used for tattooing due to its darkening effect when it is mixed with henna (*Lawsonia Alba*).<sup>7,8</sup>

PPD can be ingested accidentally, can be taken orally for suicidal purpose or can also be given to someone for attempted murder.<sup>7</sup> PPD ingestion is a common, low-priced and easy way of poisoning, becoming an emerging trend of self harm in adults in many developing countries of Asia, including Pakistan.<sup>6</sup> However, its poisoning in children is almost always accidental or with intent to murder with a very high mortality.<sup>6,7</sup> Unfortunately, it is easily accessible in our region.<sup>6,8</sup>

PPD can cause contact dermatitis in susceptible individuals.<sup>9</sup> However, major systemic toxicity occurs after ingesting it.<sup>10</sup> After ingestion, PPD causes edema of face, neck, tongue, pharynx and larynx. Its poisoning also causes angioneurotic edema, rhabdomyolysis and renal failure.<sup>11</sup> PPD is known to cause multiple organ dysfunctions. It can cause death within 6-24 hours because of angioneurotic edema or fatal cardiac toxicity.<sup>12,13</sup> The outcome depends mainly on the amount ingested. The exact lethal PPD dose is not known, estimates vary from 7-10 grams.<sup>11,13</sup> There is no antidote available for this toxic substance. The mainstay of management is conservative.<sup>14</sup>

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The purpose of this study was to evaluate and assess the age-wise cases of PPD poisoning who were admitted and treated at two main hospitals of Bahawalpur.

## METHODOLOGY

This cross-sectional study was carried out at the Combined Military Hospital Bahawalpur and Bahawal Victoria Hospital, Bahawalpur after taking the permission from the administration of both the hospitals. All the cases of *Kala Pathar* PPD poisoning who were admitted and treated in emergency, pediatric or medicine ward of these two hospitals from January 2016 to April 2017 were included in the subject study. The patients having history of mixed poisoning or patients with other medical comorbidities were excluded from this study.

Data assessed included gender, age, education status, socioeconomic status, mode of poisoning (accidental, suicidal or with intent of murder), tracheostomy operation, mortality, mortality within first 48 hours etc. Patients aged less than 12 were grouped as children and those above 12 were grouped as adults. Education status was divided into different categories as; illiterate (no formal education), primary, matriculate, intermediate and bachelor and above. Individuals with family income less than Rs. 20,000 per month were termed "low socioeconomic class", families with income > Rs. 20,000 and less than Rs. 100,000 per month were termed as "middle class", and those with income > Rs. 100,000 rupees per month were classified as "high class". The groups (children and adults) were compared in terms of age, gender, education, socioeconomic background, reason of poisoning, and mortality.

All the data were entered and analyzed in statistical package for social sciences (SPSS) version 20. Chi-square test was applied for qualitative variables and T-test was applied for quantitative variables. Frequencies with percentages were given for qualitative data; while mean with standard deviation or median with inter-quartile range was given for quantitative data. P-value less than 0.05 was considered significant.

## RESULTS

In the present study, 1,258 cases of *Kala Pathar* poisoning were assessed. There were 814 (64.7%) females and 444 (35.3%) males. Their age range was from 5 - 63 years, with overall median age 21 (IQR 4.0). Out of which, 66 (5.2%) were children (<13 years) and rest 1,192 (94.8%) were adults (>13 years). In adults, median age was 21.0 (IQR 4) years, and among children, median age was 11 (IQR 3) years (Table I).

Among children, there were 43 (65.15%) males and 23 (34.84%) females. In contrast, among adults the majority were females i.e. 791 (66.36%), and 401 (33.64%) were males.

**Table I:** Demographic profile.

Demographic variables	Group		Total (N=1,258)	P-value
	Adults (N=1192)	Children (N=66)		
Socioeconomic status				
Low	758 (63.59%)	60 (90.90%)	818 (65.02%)	<0.001
Middle	417 (34.98%)	6 (9.09%)	423 (33.62%)	
High	17 (1.43%)	0 (0%)	17 (1.35%)	
Education				
No formal education (illiterate)	746 (62.58%)	63 (95.45%)	809 (64.31%)	<0.001
Primary	350 (29.36%)	3 (4.54%)	353 (28.06%)	
Matric	58 (4.86%)	0 (0%)	58 (4.61%)	
Intermediate	28 (2.34%)	0 (0%)	28 (2.23%)	
Bachelor and above	10 (0.84%)	0 (0%)	10 (0.79%)	

**Table II:** Mortality of intoxicated patients .

Mortality	Group		Total (N=1,258)	P-value
	Adults (N=1192)	Children (N=66)		
Overall Mortality				
Yes	272 (22.81%)	31 (46.96%)	303 (24.08%)	<0.001
No	920 (77.18%)	35 (53.03%)	955 (75.99%)	
Mortality within first 48 hours				
Yes	211 (17.70%)	25 (37.87%)	236 (18.75%)	<0.001
No	981 (82.29%)	41 (62.12%)	1022 (81.24%)	

Among adults 1,125 (94.37%) cases were due to suicidal ingestion, followed by 62 (5.20%) accidental cases. On the other hand, only one child took *Kala Pathar* with suicidal intent, 54 (81.81%) cases ingested it accidentally. Five (0.42%) adults and 11 (16.66%) children were given this poison deliberately by others with ill intent (reportedly murder).

As far as socioeconomic status of the cases is concerned, n=818 (65.02%) belonged to poor back-ground, n=423 (33.62%) were middle class cases and n=17 (1.35%) belonged to high class. The group-wise distribution is shown in Table I. Education status of the cases has been shown in Table II. Majority of poisoning cases n=809 (64.31%) were illiterate (had no formal education). Other demographic profiles are also given in Table I.

The mortality caused by this low-cost and easily available poison was 24.08% (n=303). In adults, mortality was 22.81% (n=272) compared to 46.96% (n=31) in children (Table II). Majority of cases died within first 48 hours in hospital. Overall 18.75% (n=236) cases expired in this time period. In adults, 17.70% (n=211) cases died within first 48 hours compared to 37.87% (n=25) children as shown in Table II.

Tracheostomy was carried out in these cases to relieve breathing difficulty and impending suffocation because this poison causes gross swelling of neck, tongue and intra-oral tissue, causing dyspnea and stridor. Around n=1173 (98.01%) cases underwent tracheostomy operation.

## DISCUSSION

*Kala Pathar* (PPD) poisoning is emerging means of intentional self-harm with high mortality in Pakistan.<sup>2,6</sup> Easy availability, low cost, and harmful effects of this hair dye ingestion makes it a frequent choice for committing self-harm.<sup>6,13</sup> It is used to commit suicide or can be ingested accidentally. It can also be mixed in edibles with criminal intentions and given to innocent victims.

This study findings show females being the primary victims of this poisoning (64.7%) as compared to 35.3% males. The male to female ratio in adults is almost similar to that shown in some regional studies by Qasim *et al.* and Shakuntala *et al.*<sup>14,15</sup> However, some studies conducted in India and African countries show much more female victims than this study findings.<sup>15,16</sup> The female preponderance explanation could be its easy availability as hair dye and because of the gender inequalities and the social pressure of the society. However, in children the ratio of male to female was opposite to that in adults, as majority were males. The reason for majority of males in children is because parents let the male children roam free, more often. They also develop habit of doing errands with the fellow friends of the same age unsupervised.

This study highlights young age group (24 ±9 years) with predominantly unmarried females to be the main victims of PPD poisoning. This is consistent with almost all the studies conducted in this region and African countries.<sup>14,17</sup> Moreover, these findings are also in accordance with the WHO self-harm report for middle and low income countries.<sup>1,14</sup> However, results of a study conducted in Sindh are in contradiction to these findings, where majority of females (57%) were married. The possible explanation given by the author was the practice of early marriages in Sindh.<sup>14</sup> As seen in the present study, PPD ingestion was chiefly for deliberate self-harm/suicide in adult population. On the other hand, in children the chief cause of intake was accidental ( $p < 0.001$ ). There were 66 cases of PPD poisoning in children, which is an alarming sign. There was no study with such a large number of cases in pediatric population of this poisoning. Another alarming situation was the use of PPD in many children (16.66%) by strangers or other people with intent to murder.

Majority of the cases belonged to lower socioeconomic class and few cases in middle socioeconomic background. As far as education status of cases was concerned, majority (64.31%) had no formal education or till primary (28.06%). Only few were bachelors or highly qualified individuals among the affected. It showed a reciprocal relation between the level of education and socioeconomic class and *Kala Pathar* poisoning; the lower the education and socioeconomic status, more frequent were the cases of *Kala Pathar* intake. Results of other studies conducted in Pakistan and India, were in agreement with ours.<sup>14,17</sup>

The mortality caused by *Kala Pathar* was 24.08% in this study. The mortality in this study was almost similar to that shown by Qasim *et al.* (21%).<sup>14</sup> Similarly, Khan *et al.* reported 20% mortality due to PPD ingestion.<sup>18</sup> However, Khuhro *et al.* documented a higher mortality in their study, which was 37.5%.<sup>13</sup> Akbar *et al.* had reported even higher mortality rate i.e 47.4%.<sup>6</sup> As PPD poisoning results in gross cervicofascial and neck swelling, it causes severe shortness of breath and stridor; so, tracheostomy is carried out to relieve suffocation.<sup>19</sup> The higher mortality rates in the later studies were due to lack of proper and immediate care to these intoxicated patients including late or no tracheostomy. However, in this study, 98% patient underwent tracheostomy. Tracheostomy was done in 60% of cases in the study by Akbar *et al.*<sup>6</sup> and in 87.5% cases in the study done by Khuhro *et al.*<sup>13</sup>

Government should ban/curtail this hair dye, being responsible for so many deaths each month, and easily available at a low cost. Laws should be framed pertaining to injudicious supply to people/shops where every person can get it.

## CONCLUSION

*Kala Pathar* (PPD) is a lethal substance when ingested. In Southern Punjab, large number of cases present every month with this poisoning. This poisoning is not limited to adults, many cases of pediatric poisoning are also reported in this region, which is an alarming sign. Mortality due to *Kala Pathar* is high. Tracheostomy should be done immediately in all such cases, and high intensive multidisciplinary approach is provided.

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