

Paraphenylene diamine (Kala Pathar) poisoning in children of Bahawalpur and surrounding areas

Sumera Akram¹, Muhammad Ahmed Khan², Abdul Rehman³, Imran Qaisar⁴, Wasif Ijaz⁵, Shafaq Khalid⁶

¹Department of Pediatrics, THQ Hospital Renala Khurd, Pakistan, ²CMH Zhob, National University of Management Sciences, ³Professor, Pediatrics Department, Bahawalpur Medical and Dental College, Bahawalpur, ⁴Assistant Professor, Pediatrics, Quaid-e-Azam Medical College, Bahawalpur, ⁵Consultant Pediatrician, Health Department, Punjab, ⁶Woman Medical Officer, Health Department, Punjab

Correspondence to: Dr Muhammad Ahmed Khan, Email: akawan79@gmail.com

ABSTRACT

Background: Paraphenylene diamine (commonly known as Kala Pathar in Pakistan) poisoning is a common presentation in adults as well as pediatric patients in Southern Punjab. The study was carried out to assess paraphenylene diamine poisoning in pediatric cases.

Patients and methods: The cross-sectional study was carried out at Bahawal Victoria Hospital Bahawalpur. All the pediatric cases (<15 years age) of paraphenylene diamine poisoning reported during January 2021 to April 2022. Data was entered and analyzed in SPSS.

Results: Total 84 children presented at pediatric department of the hospital. Out of these, 43 (51.2%) were males and 41 (48.8%) were females. Age range was between 02 months and 15 years, mean age being 9.4 ± 4.49 years. Majority of cases (46.6%) ingested paraphenylene diamine accidentally, followed by suicidal intention (29.8%), homicidal intent (21.4%) and unknown motive in 2.4% cases. Of all, 49 (58.3%) died of poisoning and 35 (41.7%) survived. Of all the cases, 44 (52.4%) underwent emergency tracheostomy.

Conclusions: Paraphenylene diamine poisoning in children is an alarming trend. Although majority of the cases ingested it accidentally but intake due to suicidal or homicidal reason were also high. Positive outcome was associated with higher age, carrying out early tracheostomy and mode of poisoning (homicidal cases had poorest outcome whereas accidental and suicidal pediatric cases had more chances of survival).

Keywords:

Paraphenylene diamine, Poisoning, Pediatric, Suicide, Accidental

INTRODUCTION

Paraphenylene diamine (PPD) is an aromatic amine compound that is used in different types of hair dye formulations. It can cause hypersensitivity reactions ranging from mild dermal symptoms to fatal systemic derangements. It can cause dermatitis, urticaria, rash and eczema after coming in contact with skin in susceptible individuals.¹ Skin involvement is generally limited to the area of application but sometimes can cause permanent scarring.² PPD is fatal when ingested orally in sufficient amount. It affects respiratory tract (oral and laryngeal edema) leading to lethal asphyxia, stridor and death within hours if not intervened promptly. Other systems involved by this dangerous compound are cardiac, renal, muscles, etc.³ It can cause fatal cardiac arrhythmias leading to death within 6-24 hours, but even later during hospital stay.^{2,4} Rhabdomyolysis, renal failure, multi-organ failure follow the course during hospitalization of such cases.¹⁻⁴

PPD is a toxic substance in the form of white crystals which turn brown after exposure to air.⁴ It is manufactured in United Kingdom, Japan and Germany.⁴ The ingestion of this toxic compound is either suicidal or accidental in majority of cases, but homicidal intentions have also been reported.³ The cases of its suicidal or accidental ingestion are reported commonly in Asia and Africa.^{2,4} Suicidal ingestion is frequently seen in adults with few cases being accidental.⁵ On the other hand, cases of pediatric poisoning are generally accidental.⁶

It is a cheap and easily available in local markets of Pakistan with the name of “Kala Pathar” and is used by people for dying their hairs.¹ It is also added to “henna/Black henna” used for temporary tattooing of hands and skin.²

We carried out this research to assess paraphenylene diamine (Kala Pathar) poisoning in children who presented to emergency and pediatric wards of Bahawal Victoria Hospital Bahawalpur, Pakistan.

PATIENTS AND METHODS

The cross-sectional study was carried out at Bahawal Victoria Hospital Bahawalpur, Pediatric Department

Conflict of interest: The authors declared no conflict of interest exists.

Citation: Akram S, Khan MA, Rehman A, Qaisar I, Ijaz W, Khalid S. Paraphenylene diamine (Kala Pathar) poisoning in children of Bahawalpur and surrounding areas. J Fatima Jinnah Med Univ. 2022; 16(1):33-37.

DOI: <https://doi.org/10.37018/GWSC7226>

from April 2021 to April 2022. All the pediatric cases of PPD poisoning that reported at Emergency Department or were admitted in the Pediatric Wards were included in the study. Permission was obtained from the Ethical Review Board of the hospital for subject purpose. Pediatric cases (<15 years age) who presented with PPD poisoning at Bahawal Victoria Hospital Bahawalpur were included in the study. While, adult cases of PPD poisoning or cases with mixed poisoning were excluded from the study. Hospital admission papers and relevant documents were checked in detail to collect the required data. Data included, age of patient, gender, mode/intention of poisoning (suicide, accidental or homicidal), duration of poisoning till reaching hospital, outcome of case (death or alive), tracheostomy status, cause of death, residence (rural or urban), education status of parents, socioeconomic status, etc. Age was categorized into 4 categories i.e. infants (<01 year of age), 2-5 years, 6-10 years, and 11-15 years. Education status of parents was categorized into illiterate (no formal education), primary qualified (those who achieved primary education), matriculate

(those who acquired matriculate education) and graduates (those who had achieved graduate or higher qualification). Socioeconomic status was categorized into poor (those families whose monthly income was <Rs. 20,000), middle class (monthly income was between Rs. 20,000 to Rs. 100,000) and rich (monthly income >Rs. 100,000).

All the data was entered in Statistical Package for Social Sciences (SPSS) 21 and analyzed. Simple percentages were used to express frequencies. Chi square was applied for qualitative variables and independent T test was applied for qualitative variables.

RESULTS

Total 84 children presented at pediatric emergency department of Bahawal Victoria Hospital Bahawalpur from January 2021 to April 2022. Out of these, 43 (51.2%) were males and 41 (48.8%) females. Age range was between 02 months and 15 years, mean age being 9.4 ± 4.49 years. There were 06 (7.1%) cases that were less than 01 year of age (infants). Of all, 12 (14.3%)

Table 1. Demographic and clinical characteristics and comparison between cases who died and survived

Characteristics	Died	Survived	Total	p-value
Gender				
Male	27	16	43	0.507
Females	22	19	41	
Age group				
<01 year	6	0	6	0.023
2-5 year	10	2	12	
6-10 year	13	11	24	
11-15 year	20	22	42	
Mode of poisoning				
Accidental ingestion	19	20	39	0.012
Suicide	12	13	25	
Homicide	16	2	18	
Unknown	2	0	2	
Tracheostomy status				
Tracheostomy performed	16	22	38	0.008
Duration of poisoning (mean hours)	1.82 ± 1.02	1.9 ± 0.73	1.86 ± 0.91	0.717
Paternal education				
Illiterate	31	20	51	0.780
Primary	12	11	23	
Matric	6	4	10	
Maternal education				
Illiterate	45	30	75	0.424
Primary	4	4	8	
Matric	0	1	1	
Socioeconomic status				
Poor	45	31	76	0.615
Middle class	4	4	8	
Residence				
Rural	37	24	61	0.482
Urban	12	11	23	

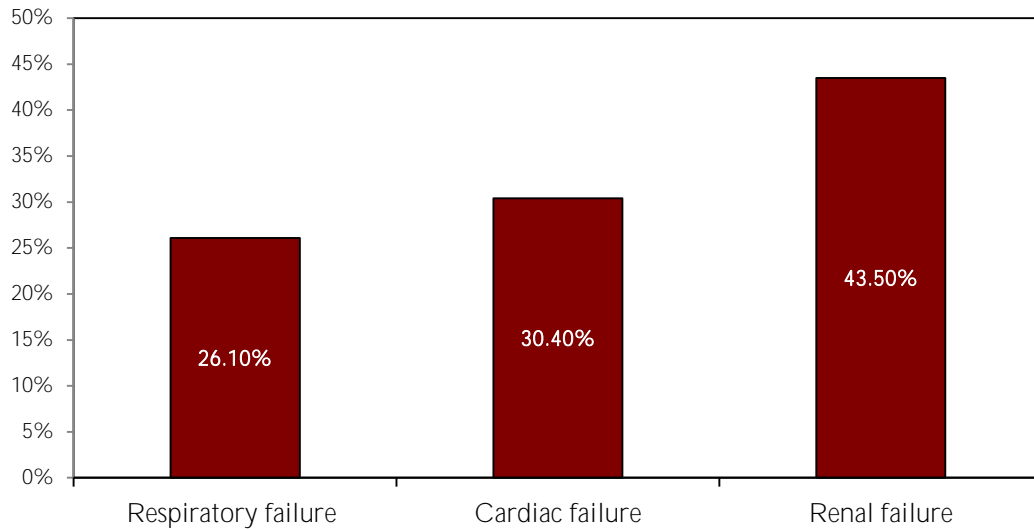


Figure 1. Causes of death in patients reported with parafenylene diamine poisoning

were between 2-5 year age group, 24 (28.6%) were in 6-10 years age bracket and rest 42 (50%) were between 11-15 years of age as shown in Table 1. Majority of cases (46.6%) ingested PPD accidentally, followed by suicidal intention (29.8%), homicidal intent (21.4%) and unknown motive in 2.4% cases as shown in Table 1. Of all, 49 (58.3%) died of poisoning and 35 (41.7%) survived. Out of all cases, 26 (31%) were brought in dead i.e. had expired before reaching hospital emergency and 58 (69%) were alive when reached hospital. Mean time between poison ingestion and reaching hospital was 1.86 ± 0.91 hours (ranged from 0.5 hour to 04 hours). Of all the cases, who were received alive in emergency department, 38 (45.2%) underwent emergency tracheostomy. Majority of parents were illiterate (60.7% of fathers and 89.3% mothers). Majority of families were from poor background (90.5%) as shown in Table 1 below. Of all, 72.6% cases belonged to rural Bahawalpur and rest hailed from urban areas.

Out of all that expired (49), 26 cases were received dead in emergency; rest 23 died in the hospital. Causes of their death have been summarized in Figure 1. The pediatric cases who survived were compared with the ones who survived in terms of age, gender, age group, mode of poisoning, tracheostomy status (whether underwent tracheostomy or not), residential status (rural or urban), socioeconomic status and education status of parents in Table 1. There was significant association between survival and age group (higher the age, more were chances of survival), tracheostomy status (tracheostomy was associated with positive outcome), and mode of poisoning/ingesting PPD, i.e.

most of homicidal cases expired and on the other hand accidental and suicidal cases had better chances to survive as shown in Table 1.

DISCUSSION

We have reported 84 cases of PPD poisoning which is alarming trend. There were 06 infants (<01 year of age), all of them were poisoned by mothers who also committed suicides. However, most frequent cause of ingesting PPD was accidental (46.6% cases) followed by suicidal ingestion in 29.8% cases. PPD poisoning proved lethal in 58.3% children that is quite high. Positive outcome was associate significantly with higher age, tracheostomy status and mode of ingestion (accidental and suicidal cases had better chances to survive as compared to homicidal cases).

Our study is unique in reporting a large number of pediatric cases of PPD poisoning. In literature, many adult case of PPD poisoning have been reported and are being reported from time to time from Pakistan especially Punjab and Sindh provinces.³⁻⁶ However, children also present with PPD poisoning but their ratio is significantly less as compared to adults.³

Sik G et al reported a rare case of PPD fatal poisoning in a 9 year old Turkish girl. The girl applied "Black Henna" (containing PPD) extensively on skin and developed cardiac arrhythmias and multi-organ failure. She eventually died on 4th day of hospitalization.²

Khan et al reported 1258 cases of PPD poisoning in Bahawalpur. Out of these, 66 (5.2%) cases were children and rest of 1192 (94.8%) were adults. In adults 1125 (94.8%) cases ingested PPD for suicide and 62

(5.2%) ingested accidentally. However among children; one child committed suicide with PPD, 11 were reportedly given PPD with ill intent (reportedly murder) and 54 children (81.8%) were accidental cases. Females were primary victim of this dreadful compound in this study (64.7%).³

Haider reported 32 cases of PPD poisoning who were received in intensive care unit of Nishtar Hosital Multan Paksitan. All of them were adults (16 – 25 years) and majority of cases were females (65.6%). All the cases had ingested the poison with suicidal intention.⁶

Akram et al reported 88 cases of PPD poisoning in Sahiwal and Gujranwala in 2018. Majority were females (78.4%). Out of them 7.9% were children and rest 93.1% were adults. PPD poisoning proved fatal in 29.5% cases.⁷ They emphasized upon the importance of early tracheostomy to reduce mortality.

Khaskheli et al reported 1032 cases of PPD poisoning from 2011 to 2016 at Nawabshah Sindh, Pakistan. Of these, 682 (66.1%) were females and 350 (33.9%) were males. Suicidal ingestion was observed in 98.9% cases, and only 8 cases (0.8%) ingested accidentally while there was 1 case of homicidal nature and cause of poisoning in 2 could not be ascertained.⁸

Tracheostomy is vital to relieve respiratory distress due to severe laryngeal and oral edema caused by PPD. It should be carried out as emergency procedure if the patient is received with respiratory distress. Even if the patient is not in respiratory distress at the time of examination by clinician, even then it should be performed to prevent impending laryngeal edema and asphyxia which is a disastrous complication of PPD ingestion.³

Shigidi et al have reported 30 cases of PPD poisoning from Sudan (Africa), comprising mainly of adult females. Only one patient died of poisoning i.e. mortality was 3.3%.⁹ PPD poisoning cases have also been reported from India.^{10,11} Majority of poisoning cases reported in literature are females.^{2,3,6,7,12,13} Most of PPD poisoning belonged to lower socioeconomic class. PPD being cheap and readily available in market makes it a frequent choice of suicide.^{3,7} Most of the adult PPD poisoning reported in literature were illiterate.^{3,7}

Mortality with this poison has been reported between 20-68.8% in Pakistan and between 0.03% to 60% in literature^{6,13,14} which is quite high. Mortality has been associated with dose ingested, time to reach hospital, tracheostomy and intention of ingesting.^{2,3,6,15}

Government should take stern steps and ban the sale of this cheap poisonous compound on shops in Pakistan. Parents should be very vigilant and keep it out

of range of children. Clinicians should be aware of typical clinical presentations and urgent tracheostomy should be carried out to avoid respiratory failure due to severe laryngeal edema.

CONCLUSIONS

PPD poisoning in children is an alarming trend. Majority of pediatric cases of PPD poisoning are due to accidental ingestion. However, older children also used it to commit suicide. Main causes of death in expired cases were respiratory failure, cardiac arrhythmias and renal failure. Positive outcome was associated with higher age, earlier tracheostomy and mode of poisoning (homicidal cases had poorest outcome whereas accidental and suicidal pediatric cases had more chances of survival).

REFERENCES

1. Abdelraheem M, Hamdouk M, Zijlstra EE. Review: paraphenylenediamine (hair dye) poisoning in children. Arab Journal of Nephrology and Transplantation. 2010; 3: 39-44.
2. Sik G, Citak A. Fatal paraphenyleneamine poisoning due to black henna. The Turkish Journal of Pediatrics. 2016; 58(3): 301-4.
3. Khan MA, Akram S, Shah HBU, Hamdani SAM, Khan M. Epidemic of Kala Pathar ((paraphenylene diamine) poisoning: An emerging threat in Southern Punjab. Journal of College of Physicians and Surgeons Pakistan. 2018; 28(1): 44-47.
4. Sultan MO, Khan MI, Ali R, Farooque U, Hassan SA, Karimi S, Cheema O et al. paraphenylenediamine (Kala Pathar) poisoning at the National Poisoning Center in Karachi: A prospective study. Cureus. 2020; 12 (5): e8352.
5. Bokutz M, Nasir N, Mahmood F, Sajid S. Hair dye poisoning and rhabdomyolysis. Journal of Pakistan Medical Association 2015; 64(4): 425-6.
6. Haider SA, Sultan A, Salman Z, Waris S, Bandesha Y. Paraphenylenediamine poisoning: Clinical presentations and outcome. Anesthesia, Pain & Intensive Care. 2018; 22(1): 43-47.
7. Akram A, Shahid A, Tariq M. Kala Pathar (paraphenylene diamine (Kala Pathar) poisoning: Roles of tracheostomy: Our experience at DHQ Hospitals. Pakistan Journal of Medical & Health Sciences. 2018; 12(2): 865-7.
8. Khaskheli MS, Shaikh S, Meraj M, Raza H, Aslam I. Paraphenylenediamine poisoning: clinical features, complications and outcome in a tertiary care hospital. Anesthesia, Pain & Intensive Care 2018; 22(3): 343-7.
9. Shagidi M, Mohammad O, Ibrahim M, Taha E. Clinical presentation, treatment and outcome of paraphenylene-diamine induced acute kidney injury following hair dye poisoning: A cohort study. The Pan African Medical Journal 2014; 19: 163.
10. Chrispal A, Begum A, Ramya I, Zachariah A. Hair dye poisoning-an emerging problem in the tropics: An experience from a tertiary care hospital in South India. Tropical Doctor. 2010; 40(2): 100-3.
11. Jain PK, Agarwal N, Kumar P, Senger NS, Agarwal N et al. Hair dye poisoning in Bundelkhand region (prospective analysis of hair dye poisoning cases presented in Department of Medicine, MLB Medical college Jhansi). Journal of the Association of Physicians of India 2011; 59: 415-9.

12. Tanweer S, Saeed M, Zaidi S, Alam W. Clinical profile and outcome of arapheylene diamine poisoning. *Journal of College of Physicians and Surgeons Pakistan* 2018; 28(5): 374-77.
13. Lohanao AK, Yousafi AH, Malik AA, Arain KH. Hair dye crucial threat to paraphenylenediamine poisoning and its mortality rate associated with laryngeal edema: a cross-sectional study. *Rawal Medical Journal* 2017; 42(1): 60-3.
14. Ahmad E. Paraphenylenediamine (PPD) poisoning – A case report do we really know kala pathar. *Journal of Anesthesia & Critical Care* 2018; 10(2): 00353.
15. Manzoor M, Tariq A, Ahmad M. Complications of kala pathar (Paraphenylenediamine) poisoning. *Proceedings* 2017; 31(1): 1-4.