DOI: https://doi.org/10.53350/pjmhs20221612842

ORIGINAL ARTICLE

Incidence, Clinical Presentation and Outcomes of Paraphenylenediamine (Kala Pathar) Poisoning in Patients Presenting at a Tertiary Care Hospital: a Prospective Study

USMAN SHAHID BUTT[1], AFTAB ALAM TANOLI[2], AISHA RASHEED[3], SADAF NADIR[4], ABDUL SAMAD[5], SALMAN PERVAIZ RANA[6]

[1]MBBS, M.Phil, MCPS (Forensic Medicine & Toxicology), Assistant Professor Forensic Medicine & Toxicology Government Khawaja Muhammad Safdar Medical College Sialkot

[2]MBBS, MPhil (Forensic Medicine & Toxicology), Associate Professor, Department of Forensic Medicine and Toxicology, Loralai Medical College, Loralai

[3]MBBS, MD, CHPE, Forensic Medicine Assistant Professor Forensic Medicine and Toxicology, Liaquat University of Medical and Health Sciences, Jamshoro Sindh (LUMHS), Pakistan

[4]Associate Professor Forensic Medicine Department CMH Medical and Dental College, Lahore

[5]MBBS, D DIAB, DFHC, DMJ, CHPE, Associate Professor Department of Forensic Medicine & Toxicology, Liaquat University of Medical & Health Sciences, Jamshoro Sindh

[6]Assistant Professor Department of Forensic Medicine, CMH Medical and Dental College, Lahore

Correspondence to: Aftab Alam Tanoli, Email: drmemonmpk1970@gmail.com

ABSTRACT

Objective: To assess the demographics, clinical features and outcomes of PPD poisoning in such patients.

Design of the Study: It was a prospective study.

Place and Duration of Study: In this cross-sectional study, the prospective study data of 47 cases were collected from Department of Forensic Medicine and Toxicology, Loralai Medical College, Loralai.

Patients and Methods: From 2019 to 2022, data of 47 cases was taken worth of information were gathered from hospitals' medical records for this prospective study. Information on the subject's demographics, ingestion method, clinical features, and mode of administration was recorded using a standardized format. In addition to monitoring mortality rates, hospital stays, tracheostomies, and the efficacy of mechanical ventilation, a number of other metrics were collected. For continuous variables' means and standard deviations (SDs) were calculated. However, percentages were calculated for categorical variables.

Results of the Study: Out of 47 patients, 38 (80.85%) were females and 9 (19.15%) were males. During first year of the study, only six cases were reported while in succeeding years cases increases rise rapidly and reached to fifteen in last year final year of the study. Majority of the patients 16 (34%) belong to age group 20-24 years. Nearly, 85% of the patients belong to the rural areas. Moreover, the rate of PPD poisoning in married women increases alarmingly from one case in 2019 to nine cases in 2019.

Practical Implication: Currently, there is limited data available on this poisoning as it has emerged as a new tren in our local hospitals. So, the rationale of this study is to evaluate the clinical presentation and outcome of the PPD poisoning in our part so that effective preventive and treatment strategies can be implemented at the onset which would certainly decrease the morbidity and mortality associated with this deadly poisoning. This study can lay down a base for local administrative authorities to consider formulating a law for strict handling of the PPD poisoning at local level and for education of the population.

Conclusion: There is a significant amount of distress and death that comes along with PPD poisoning. In order to effectively handle poisoning situations, doctors must be aware of the clinical features and therapeutic choices. In addition, PPD-containing hair colours should be banned because they are so dangerous.

Keywords: Poisoning, Suicide, Hair-Dye, Cervicofacial Edema, Paraphenylenediamine, Kala Pathar

INTRODUCTION

One million people die from suicide every year, making it one of the leading causes of mortality worldwide even though it is completely avoidable. Worldwide, suicide is a major public health issue that needs urgent attention.[1,2] Their numbers have increased just in Asia over the previous half century, and the rest of the developing world is considered to be less affected. The annual mortality toll is close to 0.8 million. This equates to around 16 suicides for every 1,000,000 individuals. Surprisingly, Asia accounts for 60% of the world's suicides. In 2012, there were 13377 suicides recorded in Pakistan, at a rate of 7.5 per 100,000 inhabitants.[3,4] There is intriguing research into the impact that psychological and mental issues play in death. There are also several medical conditions, such as cancer, chronic illness, AIDS, and liver failure which is linked to suicidal ideation. Suicide is becoming an increasingly serious public health problem, as reported by the World Health Organization (WHO).[5] Poisoning itself is the most typical method of intentional self-harm. In developing countries, mortality rates are disproportionately high because of a lack of education about the dangers of commonly used poisons and inadequate access to medical care.[6]

Multiple methods of self-injury are identified, as well as numerous means of suicide. Numerous methods, some more common than others, are used for this purpose, including organophosphorpous poisoning, acids, alkalis, kala pathar, acetaminophen, wheat pills, narcotic medications etc. These can be affected by factors like the agent's toxicity level, cost and accessibility.[6] In Pakistan, a popular and cheap hair dye is called Kala Pathar (black stone). PPD, one of its chemical components, is highly poisonous and potentially fatal in large doses. Combining PPD with hydrogen peroxide and ammonia, a byproduct of coal tar, produces a hair dye that is widely used. When combined with henna, it produces a darker ink, making it useful for tattooing (Lawsonia Alba).[7]

Consuming PPD leads to organ dysfunction. The toxicity of PPD mostly relies on how much of it is consumed. It is estimated that 7-10g is the toxic dose. Consumption of PPD results in angioneurotic edoema, which produces cervico-facial inflammation, which leads to hypoxia and rhabdomyolysis, which results in renal failure.[8,9] Severe sinusitis, tachycardia, face, bradycardia, edoema of the neck, larynx, tongue, and throat, toxic hepatitis, and hemodynamic instability are common symptoms. Arrhythmia, hypoxia, rhabdomyolysis, and renal failure all occur rapidly after PPD consumption, leading to a significant fatality rate in the early stages.[10]

Due to the lack of a definitive diagnostic test, clinicians must rely on clinical assessment, laboratory investigation, and a thorough patient history to arrive at a diagnosis. The lack of a specific antidote means that, for the time being, the only therapeutic option is conservative care, which entails measures such as a high fluid intake (through diuresis) and a tracheostomy (to clear the airway in the event of respiratory failure).[11] When patients present with neck edoema following PPD consumption, this is a symptom that they need emergency tracheostomy to prevent airway obstruction. Dialysis is necessary for individuals

presenting with failure of kidney, and early stomach pumping has a role in lowering mortality.[12]

Numerous researches have highlighted the use of black stone poisoning as a new method of suicide. Because conservative treatment is not recommended for many conditions, prompt clinical judgement is essential. Thus, the study's objectives are to discover what causes PDD poisoning and to highlight its symptoms, causes, and clinical judgment-based treatment and outcome for patients.

The authors of this article set out to learn more about the demographics of suicide by poisoning with 'Kala Pathar' hair colour in both urban and rural parts of District Bahawalpur, Pakistan, and to disseminate that knowledge to others.

PATIENTS AND METHODS

Study Setting: Department of Forensic Medicine and Toxicology, Loralai Medical College, Loralai

Study Duration: Over 4 years' time period from 2019 to 2022.

Study Design: it was a prospective study.

Inclusion Criteria: Based on the patient history provided by the attendants and the results of the clinical examination, the diagnosis of PPD poisoning was one of the criteria for patient inclusion..

Exclusion Criteria: The study did not include patients with known co-morbidities related to the heart, liver, or kidneys.

Methodology: The university's Ethical Review Committee officially gave their approval. The data was obtained from the medical files of hospitalised patients. PPD poisoning was diagnosed by obtaining information on the patient's medical history, the patient's symptoms, the patient's physical appearance, the patient's intention behind poisoning them, how long it had been since they had consumed the poison, and when they had sought medical assistance. Records were analysed with respect to the following dimensions: demographic information, clinical presentation, laboratory results, management, cause of ingestion and outcome.

Data Analysis: SPSS version 19 was used to conduct the statistical analysis of the data collected. For each age group and time period of poisoning, the mean and standard deviation (SD) were determined. Gender, and outcome (improvement, hospital discharge, referral, or death) frequencies and percentages were calculated. A post-stratification Chi-square test was employed to determine statistical significance, and a value of p 0.05 indicated the absence of null hypothesis and the presence of a difference between the two groups.

STUDY RESULTS

There were 47 incidents of PPD poisoning reported to hospital emergency rooms between 2019 and 2022. Of these, 38 (80.15%) were women with average ages of 27.4±3.9 in 2019, 23±3.2 in 2020, 26.4±12 in 2021, and 26±6.4 in 2022. In contrast, nine males (19.15%) had mean ages of 18 years in 2019, 25 years in 2020, 29 years in 2021, and 29 years in 2022 a given in table 1. In all, 12.76 percent of patients were between the ages of 15 and 19 years, 34 percent were between the ages of 20 and 24 years, 25.53 percent were between the ages of 25 and 29 years, and 27.65 percent were older than 29 years as given in table 2. Sixteen of the people who had PPD toxicity were married. Unfortunately, there was only one example of a married individual in 2019, but that number steadily rose to 2, 4, and 9 in the following years.

Table 1: Year wise demographic characteristics of the patients

Years	Age (Mean ± S.D		Gender	
	Male	Female	Male (%)	Female (%)
2019	18±0	27.4±3.9	16.66	83.33
2020	25±8	23±3.2	23.07	76.92
2021	29±6.9	26.4±12	23.07	76.92
2022	29±1.4	26±6.4	13.33	86.66

Most occurrences of PPD poisoning were deliberate, whereas just a small number were accidental, according to the data. Table 2 further shows that roughly 85% of the cases were identified from rural areas and nearly 15% from urban areas. More than 90% of patients reported having trouble swallowing and speaking, as well as experiencing swelling in the neck and face as their first clinical symptoms given in table 4. Table 5 contains the findings of the measurements that were performed in the laboratory.

Table 2: Year wise demographic characteristics of the patients of marital status and poisoning reasons

Years	Marital Status		Reason of Poisoning	
	Single (%)	Married (%)	Suicide (%)	Accidental (%)
2019	83.33	16.66	83.33	16.66
2020	84.6	15.3	92.3	7.6
2021	69.23	30.7	84.6	15.38
2022	40	60	94.7	5.2

Table 3: Area of residence of included patients in study

Years	Residence of Patients	
	Urban (%)	Rural (%)
2019	0	100
2020	15.3	84.6
2021	15.3	84.6
2022	13.33	86.66

Table 4: The clinical signs of PPD toxicity, n=47

Clinical Presentation	%
Difficulty in swallowing	92.31%
Difficulty in Opening of Mouth	95.21%
Dark color urine	42.11%
Cervicofacial Edema	89.21%
Mouth redness/Oral Erythema	78.31%
Muscle pain with rigidity	98%
Throat discomfort/pain	91.22%
Difficulty in speaking	89.66%
Stridor	52.11%

Table-5: parameters from a PPD poisoning test

Parameters	Units	Lab. Values
TLC	1000 cells/mm3)	1318± 6211
Serum Creatinine	Units/L	2.9± 1.9
Hb	g/dl.	13.7± 5.11
Serum CPK	Units/L	87.22± 28.44
Serum SGPT	Units/L	1382± 429.59

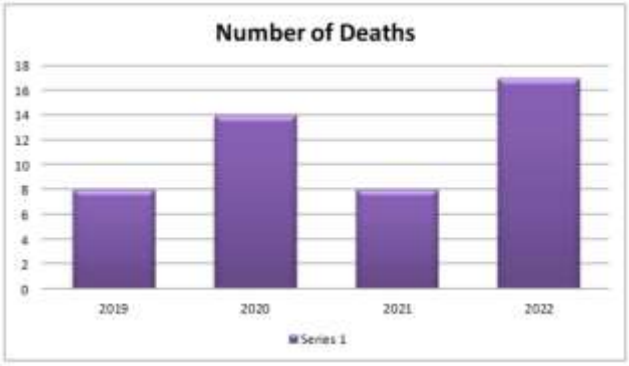

Figure 1: The numbers represent the total number of hospital deaths that happened either prior or following tracheostomy.

DISCUSSION

PPD is widely used as a hair dye in third world countries. It's a common cosmetics component used to bring out undertones in other hues. Mixing it with henna reduces how often you need to apply the dye to your skin. Its effects are systemic, meaning that they are felt not just where it happened.[13] PPD is widely used as a poisoning agent in suicides since it is cheap and easy to obtain. PPD is an extremely harmful substance since it contains a wide array of chemicals that are oxidative and pro-

inflammatory cellular damage triggers, as well as being mutagenic and carcinogenic. PPD poisoning is a serious health concern due to its wide-ranging effects.[14]

Our clientele skews heavily female, especially among the younger age brackets. Intentional poisonings typically occurred as a result of domestic strife. Patients came exclusively from rural areas with low incomes. They were predominantly single ladies. Research done both at home and abroad supports these conclusions; the majority of these studies were conducted in Asian and African countries. These include the results of research conducted by Khuhro et al. (2012) at the PUMHS, Nawabshah[15]; Akber et al. (2010) at the Nishtar Medical University in Multan[16]; Qasim et al. (2016) at the Victoria Hospital (BVH) Bahawalpur in Bahawalpur[17]; and a similar study conducted by Khan et al.[18]

Clinical features commonly observed in this research included: cervicofacial edoema (85.21%), dysphagia (92.31%), urine with a chocolate colour (42.11%), and discomfort or rigidity of limbs (98.19%). The most prevalent symptoms documented by Kallel et al. were oliguria (36.8%), dark chocolate-colored urine (74%), edoema of the upper airway (68.4%), and edoema of the cervicofacial region (79%).[20] Comparing our findings to those of Kallel et al., we find that they are in line. Our analysis, like the one by Chrispal et al., indicated that cervicofacial edoema developed first.[21]

Since there is no cure for PPD poisoning at the moment, treatment centres on making the patient feel better. Dialysis is usually necessary for individuals with acute renal failure, but none of our patients had reached that point. Lack of oxygen in the blood is the biggest threat to survival. Therefore, endotracheal intubation, mechanical ventilation, tracheostomy were crucial life-saving treatments. Sixty percent of patients at Nishtar Hospital (Multan) required a tracheostomy, according to a study.[16] fResearchers Suliman et al.[22] found that the tracheostomy rate was 15.8 percent worldwide. About a quarter of our patients needed a tracheostomy. We documented a death toll of 25%. Death rates reported by Filali et al. (21.1%) and Nishtar Hospital (20%) in Multan were similar.[16,23] This may or may not be the case depending on a variety of factors such as the nature and quantity of the poison consumed, the patient's responsiveness to medical advice, and the availability of a team of doctors capable of providing optimal care. To provide the best care possible, anesthesiologists, otolaryngologists, nephrologists, pathologists and internists must work together.

Considering how many people it kills every month and how cheap it is, the government should prohibit or significantly limit the sale of such hair dye. There needs to be legislation in place to limit the wholesale distribution of products to stores where anybody can buy them.

CONCLUSION

There is a significant amount of distress and death that comes along with PPD poisoning. In order to effectively handle poisoning situations, doctors must be aware of the clinical features and therapeutic choices. In addition, PPD-containing hair colours should be banned because they are so dangerous.

REFERENCES

1. Khuhro BA, Khaskheli MS, Sheikh AA. Paraphenylene diamine poisoning: our experience at PMC Hospital Nawabshah. Anaesth Pain Intens Care., 2012; 16(3): 243-46.
2. Sampath kumar K, Yesudas S. Hair dye poisoning and the developing world. J Emerg Trauma Shock, 2009; 2: 129-31.
3. Kallel H, Chelly H, Dammark H, Bahloul M, Ksibi H, Hamida CB, et al. Clinical manifestations of systemic paraphenylene diamine intoxication. J Nephrol, 2005; 18: 308.
4. Soni SS, Nagarik AP, Dinaker M, Adikey GK, Raman A. Systemic toxicity of paraphenylenediamine. Ind J Med Sci., 2009; 63: 164-66.
5. Lalila AH. Histopathological alterations in renal tubules of female rats topically treated with Paraphenylene diamine. World Appl Sci J., 2012; 16(3): 376-88.
6. Sakuntala P, Khan PM, Sudarsi B, Manohar S, Siddeswari R, Swaroop K. Clinical profile and complications of hair dye poisoning. Int J Sci Res Pub. 2015;5(6):1-4.
7. Jain PK, Agarwal N, Kumar P, Sengar NS, Agarwal N, Akhtar A. Hair dye poisoning in Bundel khand region (prospective analysis of hair dye poisoning cases presented in Department of Medicine, MLB Medical College, Jhansi). J Assoc Phys Ind. 2011;59:415-19.
8. Ishaque S, Jurair H, Siyal H, Kaala Pathar (paraphenylene diamine) poisoning and angioedema in a child: an unusual encounter. J Clin Toxicol 2019; 6(294): 1-5.
9. Tanweer S, Saeed M, Zaidi S, Aslam W. Clinical profile and outcome of paraphenylene diamine poisoning. J Coll Phys Surg Pak 2021; 28(5): 374-377.
10. Ram R, Swarnalatha G, Prasad N, Dakshinamurty KV. Paraphenylene diamine ingestion: an uncommon cause of acute renal failure. J Postg Med 2007; 53(3): 181-112.
11. Dorra A, Ines G, Nouioui A, Khlifi F, Salah D, Masri W, et al. Paraphenylenediamine Poisoning in Tunisia: A Case Report. Arab J Forens Sci Foren Med 2015; 230(1856): 1-5.
12. Haider SA, Sultan A, Salman Z, Waris S, Bandesha Y. Paraphenylenediamine poisoning: clinical presentations and outcomes. Anaesth Pain Inten Care 2021; 22(1): 43-48.
13. A-Rahman NH, Ahmed AM. Hair dye poisoning: An overview. J Sci Res. 2014; 2:31-3.11.
14. Sampathkumar K, Yesudas S. Hair dye poisoning and the developing world. J Emerg Trauma Shock. 2009; 2(2):129-34.
15. Khuhro BA, Khaskheli MS, Shaikh AA. Paraphenylene diamine poisoning: our experience at PMC Hospital Nawabshah. Anaesth Pain Intensive Care. 2012; 16:243-6.13.
16. Akbar MA, Khaliq SA, Malik NA, Shahzad A, Tarin SM, Chaudhary GM. Kala pathar (paraphenylene diaminntoxication; A study at Nishtar Hospital Multan. Vol 2, No 4• October – December 2010.14.
17. Qasim AP, Ali MA, Baig A, Moazzam MS. Emerging Trend of Self Harm by Using 'Kala Pathar'Hair Dye (Paraphenylene diamine): An Epidemiological Study.In APMC 2016; 1:26-30.15.
18. Khan H, Khan N, Khan N, Ahmad I, Shah F, Rahman AU, Mahsud I. Clinical presentation and outcome of patients with paraphenylenediamine (kala-pathar) poisoning. Gomal J Med Sci. 2016; 14(1).16.
19. Nautiyal S, Tiwari S, Ashutosh K. Pathar dye (paraphenyldiamine) poisoning: Our experience of this lethal emerging health problem in a tertiary care centre. Int J Otorhinolaryngol Head Neck Surg. 2017; 3(4):1056-9.
20. Kallel H, Chelly H, Dammak H, Bahloul M, Ksibi H, Hamida CB, Chaari A, Rekik N, De Broe ME, Bouaziz M. Clinical manifestations of systemic paraphenylene diamine intoxication. Journal of Nephrology. 2005 May 1;18(3):308.
21. 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 Apr;40(2):100-3.
22. Suliman SM, Fadlalla M, Nasr ME, Beliela MH, Fesseha S, Babiker M, Musa AR. Poisoning with hair-dye containing paraphenylene diamine: Ten years experience. Saudi Journal of Kidney Diseases and Transplantation. 1995 Jul 1;6(3):286.
23. Filali A, Semlali I, Ottaviano V, Furnari C, Corradini D, Soulaymani R. A restrospective study of acute systemic poisoning of paraphenylenediamine (Occidental Takawt) in Morocco. African Journal of Traditional, Complementary and Alternative Medicines. 2006 Jan 12;3(1):142-9.