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ORIGINAL ARTICLE

Paraphenylenediamine poisoning: clinical presentations and outcomes

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ABSTRACT

Background: Paraphenylenediamine (PPD), also known as Kaala pathar, has become an emerging and life threating source of poisoning in Pakistan as well as in many other Asian and African nations. The aim of this study is to recognize the etiological factors, clinical features and outcomes of patients with PPD poisoning.

Methodology: This observational prospective analytic study included 32 patients who presented in ICU of Nishtar Hospital, Multan. Patients were first managed conservatively by IV fluids, diuretics, antihistamines and steroids; tracheal intubation or tracheostomy was performed only if needed. Univariate analysis was used to determine the independent variables of mortality after PPD poisoning and odds ratios were calculated.

Results: Cervicofacial edema, oral erythema and sore throat were most common clinical presentation of patients at the time of admission in ICU, with incidence rates of 93.8%, 81.3% and 75.0%, respectively. Acute renal failure occurred in 34.4% patients and acute hepatitis in 18.75% patients. The independent predictors of mortality after PPD poisoning were: male gender (odds ratio 16.62), dysphagia (odds ratio 9.92), hyperkalemia (odds ratio 84.0), development of cardiogenic shock (odds ratio 36.75), acute renal failure (odds ratio 16.62) and acute hepatitis (odds ratio 27.50). Tracheostomy was required in all 30 (93.7%), and 13 (40.6%) patients required mechanical ventilation support. In-hospital mortality was 9 (28.1%). Mean stay of patients in ICU was 3.47 ± 2.04 days

Conclusion: Paraphenylenediamine (Kaala Pathar) poisoning has become one of the major means of suicide attempts with very high mortality rate. Male gender, dysphagia at the time of presentation, hyperkalemia, cardiogenic shock, acute renal failure and acute hepatitis are the independent predictors of mortality after PPD poisoning.

Key words: Paraphenylene diamine; Poisoning; Facial edema; Tracheostomy: Mortality

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INTRODUCTION

Suicide is a legal issue in many Asian countries and is responsible for >1 million deaths (1.4% of total all-cause mortality) every year.[1] Suicide attempts are a major cause of overburden of emergency departments.[2] Various methods such as hanging, firearms or poisoning with drugs (e.g. pesticides, hair color dyes) are commonly used for suicide attempts.[3,4] Paraphenylenediamine (PPD), also known as Kaala pathar, has become an emerging and life threating poisoning in Pakistan as well as in many other Asian and African nations.[5,6] PPD poisoning was the most dominant source of death in 1990s in Morocco.[7] PPD is an active ingredient of many hair dyes and

Table 1: Demographic characteristics

Variable		Value
Age (y)		21.06 + 3.25 (16-25)
Gender	Male	11 (34.3)
	Female	21 (65.6)
Socio-economic Status	Upper	2 (6.3)
	Middle	11 (34.4)
	Poor	19 (59.4)
Residential Status	Urban	18 (56.3)
	Rural	14 (43.8)
Marital Status	Single	24 (75.0)
	Married	8 (25.0)

Data given as number (%) except age which is presented as mean + SD along with range.

Table 2: Clinical presentations

Variable	n (%)
Sore throat	24 (75.0)
Oral erythema	26 (81.3)
Cervicofacial edema (CFE)	30 (93.8)
Difficulty in opening of mouth	4 (12.5)
Dark color urine	2 (12.5)
Oliguria/anuria	11 (34.4)
Hyperkalemia	11 (34.4)
Acute renal failure	11 (34.4)
Rhabdomyolysis	15 (46.9)
Sinus bradycardia	2 (6.25)
Sinus tachycardia	19 (59.4)
Hemodynamic shock	9 (28.1)
Acute hepatitis	6 (18.75)

Table 3: Laboratory parameters

Parameter	Value
TLC (1000 cells/mm3)	11165.13 ± 9977.34
CPK (Units/L)	81.05 ± 47.70
Serum creatinine (mg/dl)	2.32 ± 1.91
SGPT (Units/L)	1594.59 ± 870.49
SGOT (Units/L)	3094 ± 2708.86

TLC= total leukocyte count, CPK= creatinine phosphokinase, SGPT= Serum glutamate pyruvate transaminase, SGOT= serum glutamic-oxaloacetic transaminase

is easily available in market. It is used in hair dyes and in henna to accelerate the dying process and to make the color of the henna or die darker.[8,9] Its concentration varies from 0.2% to 3.75% depending upon the product. Angioedema of the upper airway tract along with dry, swollen and bloating tongue are typical features of poisoning of PPD.[10] It may also result in acute renal failure due to deposition of toxic PPD metabolites in renal tubules.11 Is can also cause acute hepatitis.[6] Death occurs within 24 hours in many patients.[10,12]

Because of the unavailability of an antidote, the management plan of PPD poisoning is still conservative management and includes tracheostomy and excessive diuresis to prevent airway obstruction and respiratory failure respectively.[13] The burden of PPD poisoning on our emergency and intensive care unit has greatly increased over the last two to three years and it is likely to increase further. The aim of this study was to recognize the etiological factors, clinical features and outcomes of PPD poisoning patients presenting in a tertiary care facility.

METHODOLOGY

This observational prospective analysis included 32 patients who present in ICU of Nishtar Hospital Multan. Data of these patients were collected in a duration of eight months from September-2016 to April-2017. We first got approval from IRB of hospital prior to starting the study. Legal informed consent from patient's first relatives was taken before including the patient's data in study. All patients who presented with PPD poisoning were included in analysis.

Diagnosis of PPD poisoning was based on clinical presentation and on the information provided by the family members or the patients themselves. Patients with previous history of PPD poisoning and any other nephrotoxins in the last six months, and those who did not sign the consent form were excluded. Patients were first managed conservatively by giving IV fluids, diuretics, antihistamines and steroids; tracheal intubation or tracheostomy was done only if needed.

We recorded each patient's clinical presentation, baseline parameters, laboratory profile, as well as outcomes, e.g. need of tracheostomy, mechanical ventilation, ICU stay and mortality.

All data were entered in SPSS v23. Descriptive statistics (e.g. mean with standard deviation or frequencies) were calculated for all study parameters. Univariate analysis was used to determine the independent variables of mortality after PPD poisoning and odds ratios were calculated.

RESULTS

All of the 32 patients who were included in this

study were of young age; the age range was 16 y to 25 y. There were 21 (65.6%) female patients. Most of the patients were unmarried and belonged to an urban area. All of these patients took PPD orally for a suicidal intention. There were no accidental poisonings.

Cervicofacial edema (CFE) followed by oral erythema and sore throat were the most common clinical presentation of patients at the time of admission in ICU with the incidence rate of 93.8%, 81.3% and 75.0%, respectively. Acute renal failure occurred in 34.4% patients and acute hepatitis in 18.75% patients (Table 2).

Laboratory parameters such as mean TLC, CPK, SGPT, SGOT and serum creatinine levels were also elevated in these patients and the recorded mean ± SD values are given in Table 3.

Tracheostomy was performed in all 30 (93.7%) patients that developed CFE and 13 (40.6%) patients required mechanical ventilation support. In-hospital mortality was 9 (28.1%) (Figure 1). Mean stay of patients in ICU was 3.47 ± 2.04 days (Figure 1).

Univariate analysis was done to determine the independent predictors of mortality after PPD poisoning. We found that male gender, presence of dysphagia at the time of presentation, hyperkalemia, development of cardiogenic shock, acute renal failure and acute hepatitis are the independent predictors of mortality after PPD poisoning (Table 4).

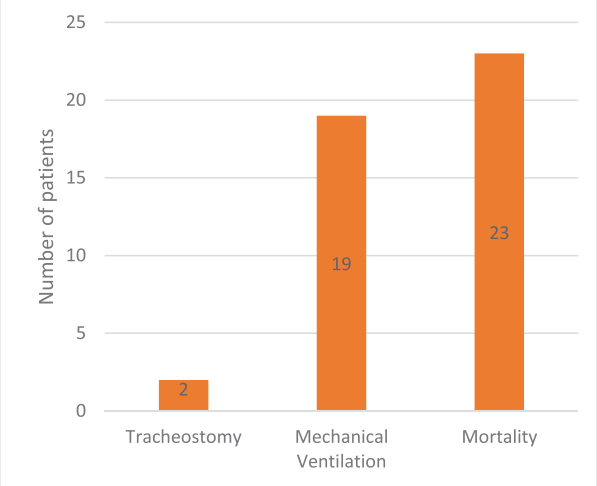

Figure 1: Procedure and outcomes of patients

Table 4: Univariate analysis of risk factors of mortality after PPD poisoning.

Risk factors of mortality	Odds ratio	95% CI	p-value
Male Gender	16.62	2.47-111.79	0.001
Dysphagia	9.92	1.60-61.59	0.015
Hyperkalemia	84.00	6.65-1059.58	<0.001
Cardiogenic Shock	36.75	4.33-311.88	<0.001
Acute Renal Failure	16.62	2.47-111.80	0.001
Hepatitis	27.50	2.50-302.17	0.001

DISCUSSION

Paraphenylenediamine (PPD) is a very strong and commonly used poison nowadays, especially in rural population, because of its ready availability and low cost. In this study, we evaluated the demographic characteristics of patients with PPD, their clinical presentation, and outcomes in our intensive care unit.

In our study, all of the patients were of young age (mean age 21.06 ± 3.25 y) and there was a predominance of unmarried females. Many other authors have also reported female predominance in patients of PPD poisoning.[14,15] In a study by Khuhro et al.14 the mean age of patients was 25.87 ± 5.59 y and in the study of Shigidi et al. mean age was 25.6 ± 4.2 y.[15] Mean age was comparatively less in our study as compared to these studies. However, the mean age in studies by Chrispal et al.16 (20.5 ± 4.65 y) and Mahsud et al.17 (22.08 ± 6.42 y), was similar to our study.

All of our patients ingested PPD as part of a suicide attempt. Rawat et al.[18] and Qasim et al.[19] also reported etiology of 100% of PPD poisoning patients in Pakistan to be suicidal attempts in their study. The incidence of suicidal attempts was 75.0% and 86.7% in Nawabshah Pakistan and in Sudan respectively according to two different studies.[14,15]

In present study, most common clinical presentation was cervicofacial edema (93.8%) followed by oral erythema (81.3%) and sore throat (75.0%). Many other studies have also reported CFE as the most common clinical presentation in PPD poisoning patients with the incidence ranging from 69.0% to 100%.[12,14,20] In our study, acute renal failure occurred in 34.4% patients and acute hepatitis in 18.75% patients. While studies from Pakistan have reported the incidence of acute renal failure to be 18.8% to 63.0% in PPD poisoning patients,[6,14,21] some international studies have reported this incidence to be 13.3% to 90%.[12,15,22]

CFE associated with PPD poisoning can result in fatal respiratory failure due to respiratory tract obstruction, so the immediate treatment in patients with cervicofacial edema is tracheostomy. In our study, tracheostomy was performed in 93.7% patients. Other studies have also reported a higher incidence of tracheostomy (15.8%-87.5%) in PPD poisoning

patients.[12,14,17] A higher number of tracheostomies are now being performed due to complications of PPD poisoning in Asia, e.g. need for mechanical ventilation.[6] 40.6% of our patients required mechanical ventilation support due to severe respiratory distress.

Male gender, presence of dysphagia at the time of presentation, hyperkalemia, development of cardiogenic shock, acute renal failure and acute hepatitis were the independent predictors of mortality after PPD poisoning. In other studies, respiratory failure, cardiac arrhythmias, angio-neurotic edema, hyperkalemia, and hypocalcemia have been reported as predominant risk factors of mortality.[22,23]

Mortality rate was 28.1% in our patients. The reported incidence of mortality after PPD poisoning is 20.0% to 68.8% in Pakistan[14,21] and 0.03% to 60.0% in international literature.[11,24]

CONCLUSION

The results of our study show that paraphenylenediamine (Kaala Pathar) poisoning has become one of the main means of attempts at suicide with high mortality rate in our country. Male gender, dysphagia at the time of presentation, hyperkalemia, cardiogenic shock, acute renal failure and acute hepatitis are the independent predictors of mortality after this poisoning. Governments need to take a legal action to stop the sale of this life-threatening poison in open markets under the label of a hair dye.

Competing interests: the authors have no competing interest.

Authors' contribution: SAH: Conceived, designed the research methodology, wrote the manuscript

AS & ZS: Helped in Data collection and writing of manuscript

SW & YB: review and final approval of manuscript to be published

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