

## ORIGINAL ARTICLE

# Clinical features and outcome of acute hair dye poisoned cases presented in Aswan University Hospital

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### ABSTRACT

Keywords: Hair dye poisoning, Paraphenylenediamine (PPD).

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**Background:** Hair dye poisoning is becoming a major issue in Upper Egypt. The main component of hair dye toxicity is para-phenylenediamine (PPD). **Objectives:** Determine age, gender, clinical manifestations and outcome of hair dye poisoned patients. **Methods:** This study was conducted in Aswan University Hospital involving patients with acute hair dye poisoning from September 2019 to March 2020 then from September 2020 till July 2021 due to Corona virus. Demographic details, previous history of suicidal attempts, clinical manifestations, length of hospital stay and outcome were noted. **Results:** Total number of 50 cases was enrolled in this study in the age group of 15-53 years, 84% were females. The intent of ingestion among studied cases was suicidal in 82%. Among the studied cases, 46 cases were presented with cervico facial edema, 31 with black urine, 29 with dysphagia, 28 with dyspnea, 9 with convulsions and 6 with leg swelling. Tracheostomy was done on 35 patients, dialysis on 6 patients and 5 patients were put on mechanical ventilation. Upon treatment, 40 patients discharged from the hospital. Ten cases died. **Conclusions:** PPD causes multi-organ toxicity. ARF is one of the leading causes of mortality.

### INTRODUCTION:

Poisoning is a preferred method of suicide and is one of the most common issues encountered in hospitals emergency departments (Sakuntala et al., 2015).

Paraphenylenediamine (PPD)-containing hair dye poisoning is becoming a new way of intentional self-harm in many developing countries of Asia, Africa and Middle-East, and it is associated with high mortality rate (Balasubramanian et al., 2014). Accidental and suicidal dye ingestion is more common in developing countries around the world (Anugrah et al., 2010).

Hair dye (HD) comes in many forms, the most common one is stone hair dye (SHD), which is widely available in North Africa and the Middle East and has the highest PPD concentration (70 to 90%) (Khan et al., 2018). SHD is the traditional name of a commercial black hair dye widely used particularly in Upper Egypt because it is available and less expensive than pharmaceutical hair dye preparation (Ahmed et al., 2013).

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PPD has been used as an ingredient in hair dyes since the nineteenth century and it is still one of the most commonly used dye precursors in permanent hair dye together with the structurally related dye precursor p-toluenediamine (PTD) (Yazar et al., 2012). It has recently gained popularity in temporary 'black henna' tattoos to speed up the darkening process and achieve a long-lasting effect (Kind et al., 2012).

PPD is hepato-nephrotoxic, myotoxic and cardiotoxic (Rawat et al., 2016). Toxicity symptoms of PPD include skin irritation, dermatitis, arthritis, asthma, conjunctivitis, exophthalmos, lacrimation, and even permanent blindness. It can cause rhabdomyolysis and acute kidney injury, flaccid paralysis, severe gastrointestinal manifestations, cardio toxicity and arrhythmias (Naqvi et al., 2015) and (Tiwari et al., 2016).

The characteristic triad of PPD poisoning is early angioedema of the face and neck with stridor, rhabdomyolysis with chocolate colored urine and acute renal failure (ARF) (Chrispal et al., 2010).

The toxic effects of PPD and the extent of the tissue damage are dose dependent. Death occurs within the first 6-24 hours of taking it orally due to angioneurotic edema. Smaller doses result in hepatitis and angioneurotic edema, whereas moderate doses result in acute renal failure within the first week (Sakuntala et al., 2015).

There isn't a particular treatment or specific antidote for PPD. Early tracheostomy is required for PPD poisoning due to its high mortality rate, hence aggressive management in coordination with other specialists, especially ENT, is essential (Garg et al., 2014).

#### **AIM OF THE WORK:**

This study aimed to:

- 1- Determine the prevalence of acute paraphenylenediamine (PPD) toxicity cases in Aswan University Hospital in one year from November 2019 to November 2020 as well as demographic data, clinical features and outcome of these patients.
- 2- Focus on the importance of adequate history taking, early recognition of the toxicity symptoms, transition period between ingestion of toxin and hospital admission and prompt management of toxicities.

#### **PATIENTS AND METHODS:**

A total of fifty patients with history of hair dye poisoning were analyzed after the approval of ethical committee of Aswan University under the number of 19/9/415. This study was conducted as a prospective study in the Emergency Department, Aswan University Hospital in the period from September 2019 to March 2020 then continued from September 2020 till July 2021 due to Covid-19 pandemic.

A detailed clinical history was recorded including demographic data (name, age, gender, residence, occupation, and marital status), intention of poisoning, type of hair dye used, time of presentation to the hospital, manner of toxicity, symptoms and clinical examination.

Treatment modalities and follow-up plan were observed from the time of hospital admission till discharge or death.

Need of tracheostomy, dialysis, mechanical ventilation and fate (Survived / Died) were recorded.

#### **Statistical Analysis**

All results were expressed as mean  $\pm$  SD. Data were analyzed using SPSS (statistical Package for the Social Sciences) version 26. P value < 0.05 is considered statistically significant.

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## RESULTS:

A total of 50 patients with a history of hair dye poisoning were admitted to the Emergency Department of Aswan University Hospital in the period from September 2019 to March 2020 then continued from September 2020 till July 2021.

The patient's results were divided into: demographic data, history analysis, symptoms analysis, treatment modalities, the outcome of patients and finally correlation between the different treatment modalities and the outcome.

The mean age of the studied cases was  $26.56 \pm 10.86$  years (ranged from 15 years to 53 years old). About half of the cases (27 cases) were in the age group from 15 to 25 years (54% of studied cases), 12 cases were in the age group from >25 to 35 years (24% of studied cases), 7 cases were in the age group from >35-45 years (14% of studied cases) and only 4 cases were >45-55 years (8% of studied cases). Regarding the gender, 42 cases (84% of studied cases) were females while 8 cases (16 % of studied cases) were males. As regard the residence, 27 cases which represented 54% of studied cases were from rural areas and 23 cases (46% of studied cases) were from urban areas. The highest incidence of hair dye poisoning which represented 42% of studied cases occurred among students (21 cases) followed by 13 cases among housewives (26% of studied cases), 11 cases among workers (22% of studied cases) and finally 5 cases among employers (10% of studied cases). Twenty eight cases were single (56% of studied cases) and 22 cases were married (44% of studied cases). These demographic data of the studied cases were illustrated in **table 1**.

**Table 1:** Demographic data of the studied cases.

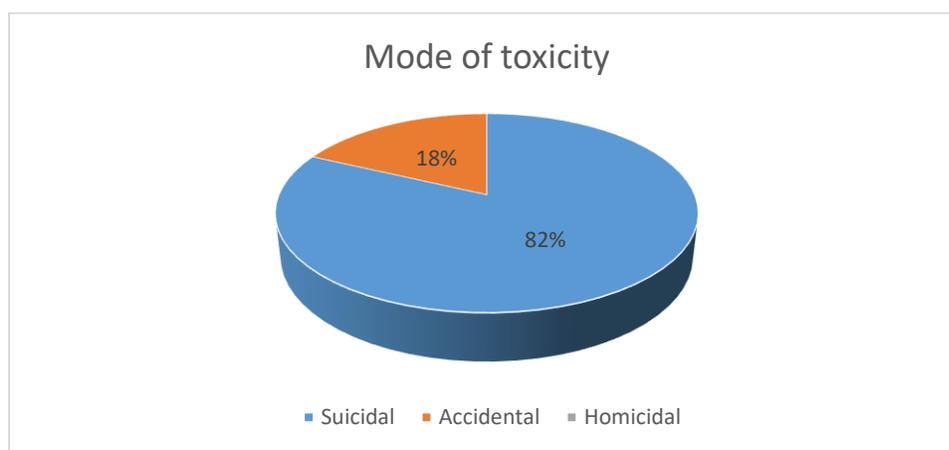
Demographic data	Number of Patients (N=50)	Percentage (%)
<b>Age (years)</b>		
15-25	27	54
>25-35	12	24
>35-45	7	14
>45-55	4	8
<b>Mean<math>\pm</math>SD</b>	26.56 $\pm$ 10.86	
<b>Range</b>	15-53	
<b>Gender</b>		
Female	42	84
Male	8	16
<b>Residence</b>		
Rural	27	54
Urban	23	46

<b>Occupation</b>		
Students	21	42
Housewives	13	26
Workers	11	22
Employers	5	10
<b>Marital status</b>		
Single	28	56
Married	22	44

SD = Standard deviation.

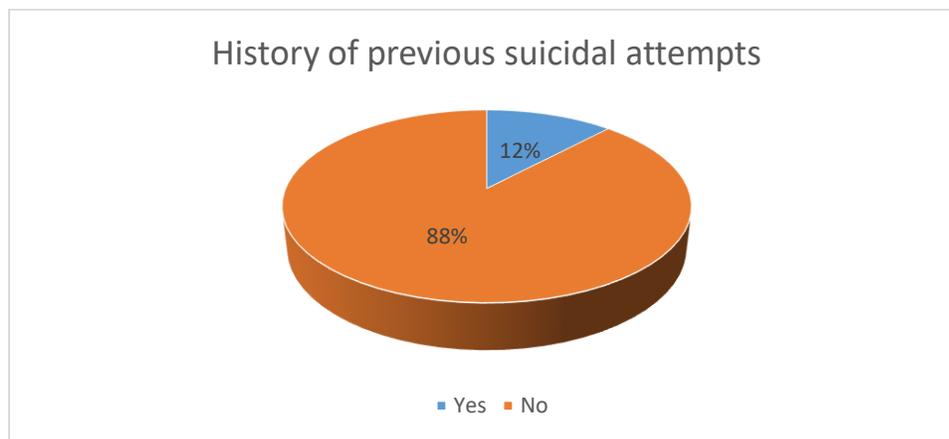
In this study, all patients consumed stone hair dye and couldn't detect the volume of dye ingested as no accurate data from the patients or their relatives.

The highest incidence of the cases which represented 82% of studied cases was suicidal (41 patients) and only 18 % of the studied cases were accidental exposure (9 patients). No homicidal cases were present in the studied cases as shown in **figure 1**.



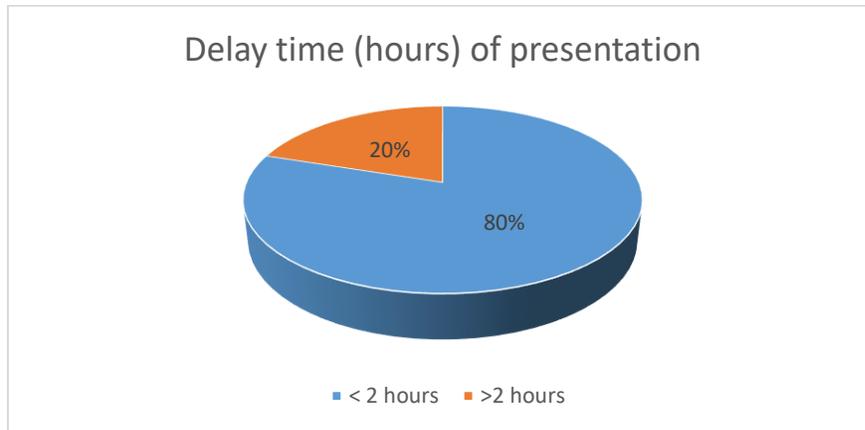
**Fig. 1:** Mode of toxicity of the studied cases.

Forty four cases which represented 88% of studied cases with no history of previous suicidal attempts while 6 cases (12% of studied cases) had history of previous suicidal attempts as shown in **figure 2**.



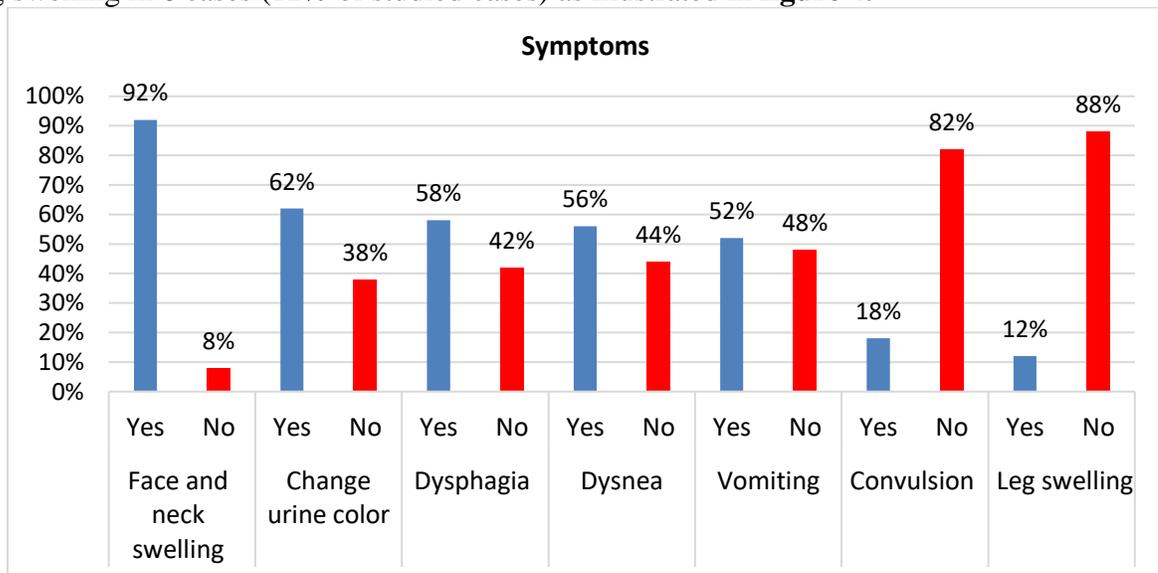
**Fig.2:** History of previous suicidal attempt among the studied cases.

Regarding the delay time of presentation, 80% of the cases presented to hospital within the first two hours (40 cases) while 10 cases presented after two hours (20% of studied cases) as shown in **figure 3**.



**Fig. 3:** The delay time of presentation in hair dye poisoned cases.

The most common symptoms of hair dye poisoning were face and neck swelling that was presented in 46 cases (92% of studied cases), dark urine color in 31 cases (62% of studied cases), dysphagia in 29 cases (58% of studied cases), dyspnea in 28 cases (56% of studied cases), vomiting in 26 cases (52% of studied cases), convulsions were developed in 9 cases (18% of studied cases) and leg swelling in 6 cases (12% of studied cases) as illustrated in **figure 4**.



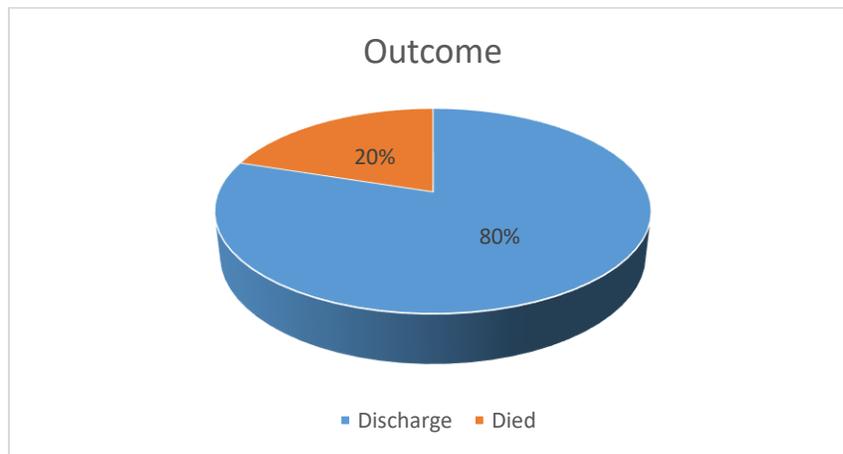
**Fig. 4:** Clinical presentation of the studied cases.

Regarding the length of hospital stay and lines of management of the presented cases, forty cases (80% of studied cases) survived and discharged from hospital after a mean duration of hospital stay of nearly 10 days ( $9.64 \pm 6.72$ ) (ranging from 2-28 days). Thirty five cases (70% of studied cases) needed tracheostomy, dialysis was done on 6 cases (12% of studied cases) and 5 cases (10% of studied cases) were put on mechanical ventilation as shown in **table 2**.

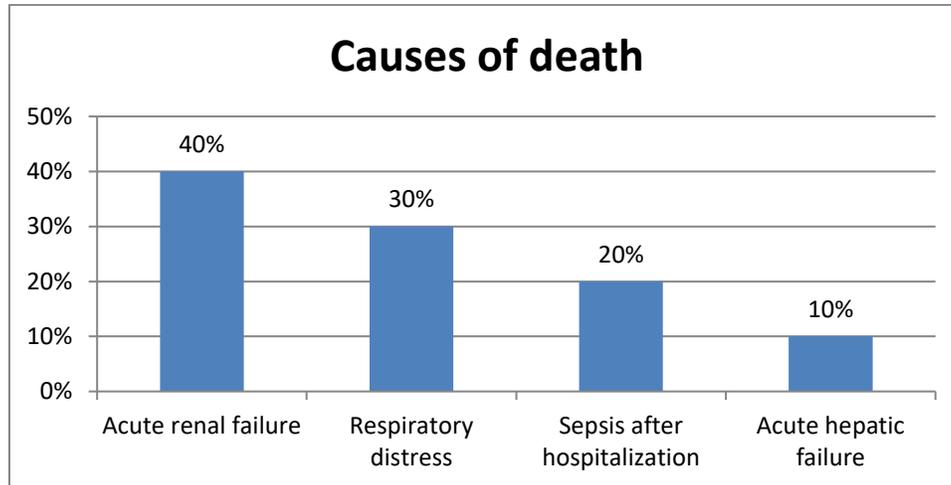
**Table 2:** Length of hospital stay and treatment modalities of the studied cases.

	Range	Mean±SD
Length of hospital stay (days)	2 – 28	9.64±6.72
Management	Number of patients (N=50)	Percentage (%)
<b>Tracheostomy</b>		
Yes	35	70
No	15	30
<b>Dialysis</b>		
Yes	6	12
No	44	88
<b>Mechanical ventilation</b>		
Yes	5	10
No	45	90

Regarding the outcome of the studied cases, forty cases (80% of studied cases) survived while ten cases (20% of studied cases) died during hospitalization due to ARF in 4 cases (40% of dead cases), respiratory distress in 3 cases (30% of dead cases), sepsis after hospitalization in 2 cases (20% of dead cases) and acute hepatic failure in one case (10% of dead cases) as shown in **figure 5** and **figure 6**.



**Fig. 5:** Outcome of the studied cases.



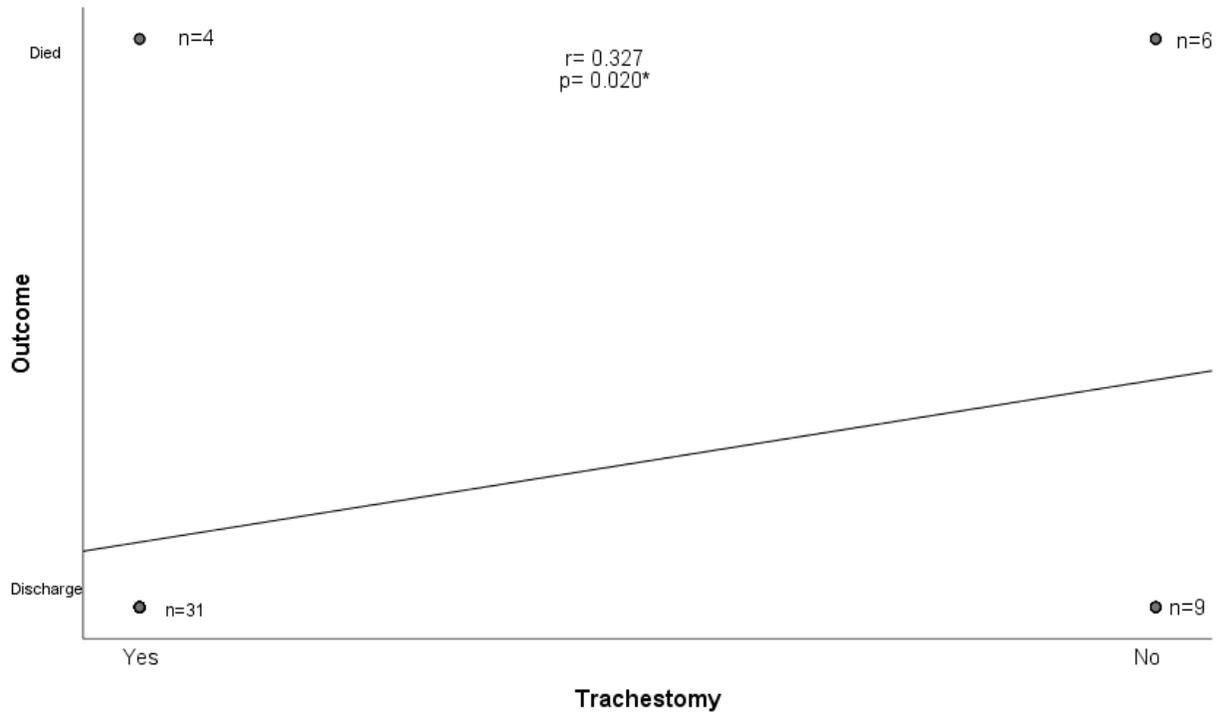
**Fig. 6:** Cause of death among the dead cases.

There was positive correlation with statistical significant difference between tracheostomy and the outcome ( $r= 0.327$ ,  $p =0.020$ ). It showed that thirty one cases that underwent tracheostomy discharged while four cases died as documented in **table 3 and figure 7**.

**Table 3:** Correlation between different treatment modalities and the outcome of hair dye poisoned cases by Spearman correlation.

Different treatment modalities	Outcome	
	r value	P value
Tracheostomy	<b>0.327</b>	<b>0.020*</b>
Dialysis	0.185	0.199
Mechanical ventilation	0.167	0.247

\*Statistically significant difference ( $p \leq 0.05$ ).



**Fig. 7:** Correlation between tracheostomy and the outcome of hair dye poisoned cases ( $r=0.327$ ,  $p=0.020$ ).

There was no correlation between different age groups and the outcome of hair dye poisoned cases as documented in **table 4**.

**Table 4:** Correlation between different age groups and the outcome of hair dye poisoned cases by Spearman correlation.

	Outcome				r- value	P- value
	Discharge		Died			
Age groups						
15-25 years	21	52.5%	6	60.0%	0.285	0.149
>25-35 years	11	27.5%	1	10.0%	0.045	0.890
>35-45 years	6	15.0%	1	10.0%	0.000	1.000
>45-55 years	2	5.0%	2	20.0%	0.000	1.000
<b>Total</b>	40	100.0%	10	100.0%		

\*Statistically significant difference ( $p \leq 0.05$ ).

\*\* Highly statistically significant difference ( $p \leq 0.01$ ).

## DISCUSSION:

Stone hair dye (SHD) is the traditional name for a widely used commercial black hair dye especially in Upper Egypt, because it is less expensive than pharmaceutical hair dye preparation. It is the second suicide poison in Upper Egypt after pesticides (**Zaghla et al., 2019**).

The majority of cases in this current study were in the age group of 15-25 years old and the mean age was  $26.56 \pm 10.86$  years (ranged from 15 years to 53 years old). This was agreed with **Shigidi et al., (2014)** who noted that the mean age of the study population was  $25.6 \pm 4.2$  years. While **Khan et al., (2016)** stated that the age range was 30 years (15 to 45), with a mean age of  $22.08 \pm 6.42$  years. This could be attributed to stress, social insecurity, unemployment and general lack of maturity in this age group.

The current study showed a female preponderance which represented 84% of studied cases and this was agreed with **Zaghla et al., (2019)** who reported that a total of 40 cases enrolled in their study, with 30 (75%) of them being females and 10 (25%) being males, but our results were in contradiction with **Shalaby et al., (2010)** who reported that 72% were males and 28% were females among 25 cases of PPD intoxication studied over a 7-year period (October 2001 - November 2008); The female preference for stone hair dye was explained by its low cost, ease of availability, and the close relationship between females and cosmetics.

Regarding the residence, 54% of studied patients were from rural areas, while 46% were from urban areas. This was due to the increased use of the black rock in the rural areas for cosmeses. This agreed with **Mohamed et al., (2014)** who founded that the number of toxic cases was significantly higher in rural areas than urban areas and **Khan et al., (2016)** who reported that 23 patients (60.5% of their studied cases) were from rural areas, but different from **Khuhro et al., (2019)** who reported that all their patients were from rural background.

Single females (56%) were the dominant patients in this study. This finding was in line with previous published reports by **Haider et al., (2018)** from India, but our result were in contradiction to a study by **Khuhro et al., (2019)** who reported that 56.3% of their studied cases were married while 43.8% of the cases were single.

Concerning the manner of death, a high proportion of SHD intoxication (82% of studied cases) was due to suicidal intent. This finding was quiet similar to **Zaghla et al., (2019)** who reported that the intent of ingestion was suicidal in 72.5% of their studied cases and **Haider et al., (2018)** who reported the etiology of 100% of PPD poisoning patients was suicidal attempts in their study.

The most serious and common manifestation affecting 92% of patients in this study was upper airway obstruction caused by cervico-facial edema. This finding was similar to **Khuhro et al., (2019)** who stated that cervicofacial edema was the first symptom to develop in all 16 patients (100%), but **Rawat et al., (2016)** reported cervico- facial edema in 70.76% and **Shigidi et al., (2014)** recorded edema in 53.3% of patients.

Dyspnea was founded in 56% of studied patients and this was quiet similar with **Zaghla et al., (2019)** who founded dyspnea in 67.5 %, but **Khan et al., (2016)** reported dyspnea in 94.7%.

Dysphagia in our results was observed in 58% of studied patients. This disagreed with **Ramulu et al., (2016)** who noted dysphagia in 83.8% of their studied cases and **Khuhro et al., (2019)** who stated that dysphagia occurred in all their patients (100%).

In the present study, dark colored urine was observed in 62% of studied patients. It was quite similar to **Ramulu et al., (2016)** who noted dark color urine in 58% patients.

Vomiting was occurred in 52% of studied cases. **Ramulu et al., (2016)** noted vomiting in 80.6% of their patients.

Convulsions were occurred in 18% of studied patients. This in accordance with **Ramulu et al., (2016)** who founded seizures in 12.9% of their patients and **Zaghla et al., (2019)** who founded it in 10% of their patients.

In this study, 70% of patients underwent tracheostomy. Because of the complications of PPD poisoning, a greater number of tracheostomies were performed. This result was quite similar to studies done by **Khan et al., (2016)** who stated that tracheostomy was performed in 29 (76.3%) patients with cervico-facial edema and **Nautiyal et al., (2017)** who stated that tracheostomy was done in 69.69% of their studied cases. While a study done by **Khuhro et al., (2019)** in Pakistan founded that 87.5% of their patients required this procedure.

Dialysis was done in 12% of our patients. This result was quite similar to study done by **Jain et al., (2011)** who stated that 8.62% of hair dye poisoning cases needed dialysis during their hospital course.

Five patients (10% of studied cases) required mechanical ventilation for respiratory support. This was quietly agreed with **Ramulu et al., (2016)** who founded that mechanical ventilation was required in 3% of patients, but disagreed with **Khuhro et al., (2019)** who stated that mechanical ventilation was needed in 75% patients.

Regarding the outcome, we founded that mortality was 20%. This was in agreement with **Akbar et al., (2010)** at Multan who stated mortality in 20% of their studied cases and **Rawat et al., (2016)** who reported mortality in 21.53% while **Khuhro et al., (2019)** at Nawabshah observed slight high mortality rate (37.5%) than our study and explained this difference might be due to delayed admission to hospital and delayed recognition.

The most common causes of death in our study were ARF that occurred in 40% of dead cases, respiratory distress in 30% of dead cases, sepsis in 20% of dead cases and acute hepatic failure in 10% of dead cases. This result was quiet similar to studies done by **Akbar et al., (2010)** who stated that ARF occurred in 37.5% patients, **Khan et al., (2016)** who noted that rhabdomyolysis was observed in 80% of their patients with 40.5% developing ARF.

Compared to our findings, other studies founded a higher incidence of ARF as by **Ishtiaq et al., (2017)** in Pakistan who reported that thirty-seven of 39 cases (95% of their studied cases) developed acute renal failure and **Khuhro et al., (2019)** in a study of 16 patients from Nawabshah reported ARF in 81.3% patients.

Other studies reported lower incidence of ARF than our results as by **Ramulu et al., (2016)** who noted that acute renal failure (ARF) was seen in 19% of their patients

In this study, survival of patients was statistically significant correlated with tracheostomy. It was found that mortality was highest in the group which did not undergo tracheostomy ( $r=0.327$ ,  $p=0.020$ ). This was agreed with **Balasubramanian et al., (2014)** who stated that mortality rate was highest in the group which had edema and did not undergo tracheostomy, and lowest in the group without edema and do tracheostomy ( $P < 0.001$ ).

#### CONCLUSION:

According to the findings of this study, PPD-containing hair dye has emerged as a potential suicidal poison with a higher prevalence in Aswan University Hospital. Morbidity and mortality are caused by its impact on the vital organs. Intervention including tracheostomy is the corner stone of management.

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**List of abbreviations:**

PPD: Para-phenylenediamine.

HD: Hair dye.

SHD: Stone hair dye.

PTD: P-toluenediamine.

ARF: Acute renal failure.

SD: Standard deviation.