

Original Research Article

A prospective study on clinical profile and incidence of acute kidney injury due to hair dye poisoning

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ABSTRACT

Background: Globally suicides are mounting at an alarming rate over the last few decades thus claiming the most productive age group of the society. Developing country like India is no exception to this needless increasing toll.

Methods: This study was a prospective observational study with 31 patients recruited at Osmania General Hospital between November 2011 – October 2013. Patients of alleged hair dye ingestion admitted in MICU were taken up for study after the exclusion criteria were ruled out. Informed consent was obtained from every patient or patient's relatives. All routine laboratory investigations were done basing on standard clinical procedures and protocols and patient related clinical information were recorded on the prepared proforma from the time of hospital admission till discharge or death. The presence of AKI was defined and graded as per the RIFLE criteria.

Results: The present work examines 31 cases of suicidal ingestion of hair dye, out of which males were 6 (19.35%) and females were 25 (80.64%). It was observed that the tendency to commit suicide was more in the age group 21 -30 years with males (30%) and females (70%). 19% of total patients who ingested more than 50 ml of dye had developed Acute Kidney injury requiring hemodialysis. Upon treatment about 58% of patients were discharged from hospital in good general health condition, Four patients expired due to respiratory complications with pneumonia, ARDS, sepsis and ARF.

Conclusions: So in current scenario of emerging hair dye poisoning, it is imperative for a timely intervention by reducing the time of admission in hospital and also early management by clinicians is the need of an hour.

Keywords: Acute renal failure, Hair dye poisoning, Rhabdomyolysis

INTRODUCTION

Cosmetic practices are now regarded as more fashionable or desirable art. Dyeing of hair is one such cosmetic art with blend of ancient times using dyes from plants and present times involving treatment of the hair with various chemical compounds.^{1,2} Hair dyes are classified depending upon its applicability and usage.³ Commonly

used hair dye contains paraphenylenediamine (PPD) as its main constituent often added to locally used henna (*Lawsonia inermis*) to intensify its colour. PPD is widely used in fur or textile dyeing, rubber industries, photographic developing agent and also used as a main component of engineering polymers and composites.^{4,5} PPD containing hair dye poisoning has incidence of high mortality and morbidity. Its effects include contact

allergy keratoconjunctivitis, skin irritation, conjunctival swelling, and eczema of the eyelids in a sensitized individual and severe dermatitis edema of face and neck, rhabdomyolysis, severe metabolic acidosis and acute renal failure as complications seen at latter stages.⁶⁻¹⁰ Ingesting the dye accidentally and intentionally (Suicides) are more common in developing countries across the world. Many sporadic reports of the poisonings with PPD hair dyes are documented in literature but there has been no prospective observational studies regarding its clinical presentations and outcome.¹¹⁻¹⁵ The present study was thus taken up to determine clinical presentation, management and outcome of different hair dye induced AKI.

METHODS

This study is a prospective observational study with 31 patients recruited at Osmania General Hospital between November 2011 – October 2013. Patients of alleged hair dye ingestion admitted in MICU were taken up for study after the exclusion criteria were ruled out. Informed consent was obtained from every patient or patient’s relatives. All routine laboratory investigations were done basing on standard clinical procedures and protocols and patient related clinical information were recorded on the prepared profoma from the time of hospital admission till discharge or death. The presence of AKI was defined and graded as per the RIFLE criteria.¹⁶

Statistical analysis

All results are expressed as mean ± SD. The mean values in different groups were tested using student t-test. All analyses were evaluated with the help of statistical packages SPSS 17 version (SPSS, Inc., Chicago, IL, USA). A p value of less than 0.05 was accepted as statistically significant.

RESULTS

Total numbers of cases were 31, out of which male were 6 (19.35%) and females were 25 (80.64%). It was observed that the tendency to commit suicide was more in the age group 21-30 years with males (30%) and females (70%). Major signs and symptoms among patients (Table 1) were pain oral cavity (96%), vomitings (80.6%), angioedema (48.38%), dysphagia (38.70%). Others include myalgia (90.3%), oro-facial edema (83.8%), dyspnea (77.4%) of whom 29% developed stridor and 45% developed wheeze. 19% patients developed oral erythema and occasional erosions due to ingestion of the dye. 16% patients developed pedal edema, of those in whom oliguria was seen in 12% of the patients. Dark cola colour urine was witnessed in 58% patients having generalized muscle pains.

Average time of development of signs and symptoms since the consumption of the dye varied among individuals and between genders. Burning pain in

mouth/throat/abdomen, vomiting were the two symptoms which developed within a mean duration of less than one hour.

Table 1: Signs and symptoms among patients.

Signs/Symptoms	No of Patients	Percentage (%)
Pain Oral Cavity	30	96
Vomitings	25	80.6
Angioedema	15	48.38
Dysphagia	12	38.70
Dyspnea	24	77.4
Myalgia	28	90.3
Dark Urine	18	58
Oliguria	4	12.9
Seizures	4	12.9
Weakness	5	16.12
Oro-facial edema	26	83.8
Icterus	0	0
Pedal edema	5	16.12
Oral Erythema	6	19.3
Hypertension	5	16.12
Hypotension	2	6.4
Stridor	9	29
Wheeze	14	45
Epigastric tenderness	12	38

Table 2: Findings in important body systems.

Body system	Findings	No. of Patients	%
Respiratory system	Normal	4	12.9
	Stridor	9	29
	Wheeze	14	45.16
	Crackles	4	12.9
Cardiovascular system	Normal	31	100
	Murmurs	-	
	Others	-	
Gastrointestinal system	Normal	13	41.9
	Oral erythema/erosions	8	25
	Epigastric tenderness	12	38.7
Central nervous system	Normal	22	70.9
	Weakness	5	16.12
	Seizures	4	12.9
	Decreased fine touch	0	0

%: Percentage

The mean duration of development of angioedema, dysphagia and/ or dyspnea, dark colored urine, myalgias was within 24 hours (less than a day). Pedal edema with or without Anasarca and seizures and weakness appeared within a mean duration of 7-10 days. Oliguria appeared within a mean duration of 5-6 days. Hypertension was

seen within mean duration of 4-5 days, hypotension with a mean duration of 6 hrs. No Significant correlation between gender and symptom was found, except in oro facial edema which is 6% in males as compared with females 77% with a p value 0.0022 which is statistically significant.

Findings in important body systems (Table 2) include Respiratory system abnormalities that included stridor / wheeze/ crepitations were seen in nearly 83% of patients. Oral erythema / erosions were seen in 28% of the patients, and Epigastric tenderness was present in 38% of patients on GIT examination. In central nervous system examination weakness found in 16% of patients and seizures occurred in 12.9% of patients.

Table 3: Routine and other investigative findings.

Investigation	Mean	SD	Range
Total Count	11652.38	3269.01	7200-24000
Polymorphs (%)	73.39	9.23	56-92
Lymphocytes (%)	22.02	8.40	4-40
Eosinophils (%)	4.26	1.79	1-6
Monocytes (%)	1.74	0.71	0-3
Blood urea	55.57	40.73	20-150
Serum creatinine	1.60	1.38	0.6-6.2
Serum bilirubin	0.97	0.50	0.6-3.3
SGOT	67.38	51.77	28-234
SGPT	73.26	46.16	17-224
CPK	18182.14	24375.55	108-74880
Sodium	135.97	5.32	124-147
Potassium	4.63	0.63	3.2-6.2
Calcium	6.36	1.95	3-9

SGOT: Serum glutamic oxaloacetic transaminase, SGPT: Serum glutamic pyruvate transaminase; CPK-Creatine Phosphokinase.

Routine and other Investigative Findings indicated Mean values of SGOT and SGPT had considerable increase in their levels. Raised mean value of Serum Creatinine Phosphokinase (CPK) was seen. Decrease in mean serum Calcium levels was evident (Table 3).

ABG analysis was done in every patient at presentation, finding suggestive of metabolic acidosis was seen in 35% of patients. Respiratory alkalosis was seen in 39% of patients, 26% cases were normal. Further the Investigative Abnormalities listed in Table 4 were considered for further treating the patients.

Highest grade of protein urine were seen to be 3+ grade 6.4% of patients, 2+ in 41% of the patients and 1+ in 19% of patients. 32% of others had only traces of protein in urine. On microscopic examination, pigmented casts was found in 25% of patients. Chest x ray showed features of pulmonary edema in 3%, pleural effusion and consolidation in 6% of patients. ECG abnormalities were

seen in 38% of patients, mostly the abnormalities were sinus tachycardia, non-specific T wave inversions, QTc prolongation, and sinus bradycardia in one patient were observed. Renal biopsy done in 3 cases of acute kidney injury. Among 3 biopsies 2 patients showed acute tubular necrosis and remaining 1 patient showed pigment nephrosis (Table 5).

Table 4: Investigative abnormalities.

Investigative abnormalities	No of Patients	%
Raised total count (>11000)	13	41.93
Raised blood urea (40mg%)	11	35.48
Raised serum creatinine (>1.2mg%)	13	41.19
Raised bilirubin (2mg%)	2	6.4
Raised CPK (300)	25	80.64
Raised potassium (>5.5meq)	8	28.57
Serum calcium (<8mg%)	8	28.57
CUE (normal)	2	6.4
CUE (pigment casts)	2	6.4
CUE (urine proteins++)	13	41.9

Values mentioned within brackets are indicated as greater than(>), Less than (<) and maximal value (without > or <), CUE-Complete Urine Examination, CPK-Creatine Phosphokinase.

Table 5: Investigative lab and clinical examination in patients.

Investigations	Findings	No of Patients	Percentage (%)
	Nil	23	74.19
	Pigment Casts	8	25.80
Urinary protein level	Normal	10	32.25
	+	6	19.35
	++	13	41.9
	+++	2	6.4
Chest X - Ray	Normal	26	83.8
	B/l pulmonary edema	1	3.2
	Pleural effusion	2	6.4
	Consolidation	2	6.4
ECG	Normal	19	61.2
	Pathological changes	12	38.70
Renal Biopsy	Acute tubular necrosis	2	6.4
	Pigment Nephrosis	1	3.2

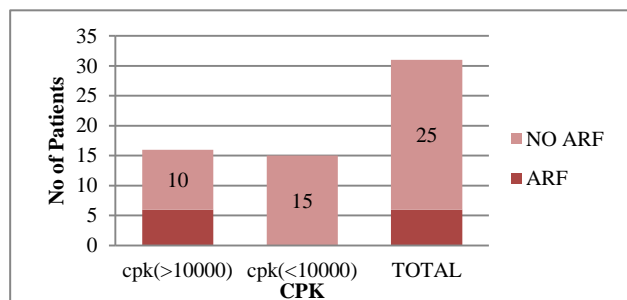
About 29% (09 patients) required tracheostomy, while 8 patients were managed with endotracheal intubation. Mechanical ventilation was required in 3% of patients

with modes of ventilation modified as per requirement (Table 6).

Table 6: Interventions among patients.

Intervention	No. of Patients	Percentage
Tracheostomy	09	29
Intubation	08	25
Mechanical ventilation	3	9.6

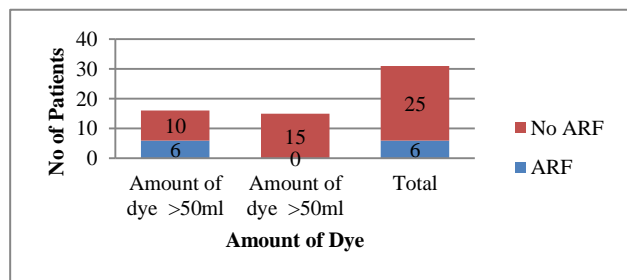
Other patients were managed with ‘T- piece’ with oxygen inhalation, and continuous SpAO₂ monitoring. On further examination majority of patients 87% of them developed angioedema of varying severity. The next most frequent complication observed was Rhabdomyolysis (CPK >1500 IU/L) which was seen in 80.9% of patients. 19% of total patients had developed Acute Kidney injury requiring hemodialysis. 6.4% of patients had Ventilator associated Pneumonia, ARDS. Hypocalcaemia was observed in 51% of patients, of whom 2 patients developed carpopedal spasms which responded to calcium administration. ARF was evident with raised CPK levels (Figure1) and increased amount of dye (Figure 2).



Fischers Exact Probability Test P two – tailed = 0.0177; statistically significant.

Figure 1: Raised CPK (>10,000) by acute renal failure.

ARF was seen in 19.3% of patients who ingested more than 50 ml of dye and was not seen in patients who ingested less than 50 ml of dye. The correlation was statistically significant.



Fischer’s Exact Probability Test P two – tailed P value = 0.0177; Statistically Significant.

Figure 2: Amount of dye (> 50ml) by acute renal failure.

Finally, about 58% of patients were discharged from hospital in good general health condition after a mean duration of hospital stay of nearly 10 days (ranging from 4-21 days). 25% of patients left against medical advice. 12% patients expired due to respiratory complications with pneumonia, ARDS, sepsis and ARF.

DISCUSSION

Poisoning by ingestion of hair dye is increasing at an alarming rate over last decade. This surge may be attributed to the oral and media propaganda within the public and its cheap and easily availability in almost all local general stores. The present study includes 31 cases of PPD containing hair dye poisoning. 29 cases consumed the hair dye available in the market with the trade name “Super Vasmol 33”, another dye “Godrej hair Dye” was consumed by 2 patients, and “Indica Hair Dye” by 1 patient.

The mean age of the patients was 24±8 (ranges 16-45) having female preponderance with 80.64% of patients being females. The studies of Filali A et al, Suliman SM et al, Yadavendraet al, Jain et al, also showed a female preponderance with 77%, 80%, 65% and 74.86% respectively.¹⁷⁻²⁰ The mean amount of dye consumed was found to be 52.31±29.56 ml in our study (range 10-100 ml). Upon ingestion 95% patients had developed burning pain in mouth, throat and abdomen. Suliman SM et al, found such G.I.T symptoms in 40% of patients in their study.¹⁸ Such symptoms were also described in the case reports by Singla S et al.²¹ Sharma A et al, detailed it at the 7th international congress of the asia-pacific association of medical toxicology at Chandigarh, India.²²

Angioedema developed in 48.38% of the patients with varying severity in present study, Other Studies done by different authors reported angioedema in 60, 79, 70, 73% of patients respectively.^{13,19,20,23} Those who presented with severe angioneurotic edema with stridor underwent emergency tracheostomy. Tracheostomy was done in 09 (28%) of patients, 8 patients (25.8%) required Endotracheal intubation, 3 (9.6%) patients required mechanical ventilation for respiratory support. Black colored urine was observed in 58% of our study population, with majority of these patients developing generalized muscle pains. Within a mean duration of 12±3 hours (range 7-18 hours). Black colour urine was described in 73.3% of the patients by Kallel et al.²³ Generalized myalgias were complained by 90.3% of the patients. Myalgias were complained after a mean duration of 9.4±3.3 hours (range 6-16 hours). In one study muscle pains were complained by 70% and weakness by 10% of their patients.¹³ 16% of patients developed pedal edema with / without anasarca and 12.9% of patients developed Oliguria in our study. It took a mean duration of 192±29.3 hours (range 168-240hours) for pedal edema and mean duration of 132±79 hours (range 48-240) hours for Oliguria in our study. Oliguria was seen in 12.54% cases and reported as 60%.^{20,24} Hypertension was noted in

16% of patients and 6.4% patients had hypotension in our study. It was observed as 33.33% in patients by Sahay M et al.²⁵

Dermatitis and itching was noted in 6.6%.¹⁸ But no person in our study population had features of dermatitis. In our study Seizures were seen in 12% of the patients and 2.25% of patients in a study.²⁰

Clinical examination revealed respiratory system abnormalities in 77% of the patients that included stridor, wheeze and crackles. Epigastric tenderness was observed in 38% of patients.

In our study, blood investigations reveal as Blood Urea in 35.48%, Increased serum creatinine in 41.19%, total increased WBC count in 41.93%, Hypocalcaemia in 28.57% of our patients and may occur in the setting of severe rhabdomyolysis.²⁶ Almost, 80.64% of the investigated patients had increased Serum Creatinine phosphokinase levels, and 42.8% of them had levels more than 10,000IU/L. ABG analysis revealed metabolic acidosis in 45% of the investigated patients and respiratory alkalosis in 24% of the investigated patients. Kallel et al noted increased CPK level in 100% of patients (with a mean 77,762).²³ Metabolic acidosis was reported in 100% of patients.

In present study, proteinuria was seen in 41% of the patients and 36.86% in patients studied by Jain et al.²⁰ Regarding complications, 46% of patients developed varying severity of angioedema. Rhabdomyolysis was noted in 80.9% of patients. Further, Rhabdomyolysis was seen in 100% of their patients.¹³ It was observed in 35%, 60% patients and reported in 20% of their patients.^{19,24,25} Acute renal failure (ARF) was seen in 19% of present patients requiring renal replacement therapy. The frequency of ARF was 47.4%, 80%, 80%, 15%, 70% with dialysis requirement in 26.3%, 70%, 60%, 9%, 70% patients.^{13,18,19,23,24} In present study a significant statistical correlation between rhabdomyolysis and ARF, CPK levels of more than 10,000 IU/L were found. Mortality was 12.9% in present study population. 2 patients who expired had undergone tracheostomy, requiring ventilator support; developed ventilator associated pneumonia and needed renal replacement therapy.

CONCLUSION

In conclusion, PPD containing hair dye has emerged as a potential suicidal poison with no specific antidote. The clinical profile of hair dye poisoning is marked by respiratory, muscular, hemodynamic and renal syndromes. Severe angioneurotic edema and acute kidney injury occurrences testifies to the severity of intoxication and predicts morbidity and mortality. Depending on complications, measures like inotrope support, emergency airway management, alkaline diuresis and renal replacement therapy are warranted. As the burden of hair dye poisoning cases increases, it is imperative that

primary care physicians, intensive care physicians and nephrologists need to be aware of its clinical manifestations and be prompt in instituting good supportive management to minimize the needless toll.

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