

Prospective study of clinical profile in hair dye poisoning (PPD) with special reference to electrocardiographic manifestations

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Abstract

Background: High suicide rate is reported in India, and poisoning seems to be main cause in majority of these suicide cases. An enhanced rate is seen in poisoning by hair dye, and in few places, it comprises a huge part of the poisoning cases.

Objective: To study the clinical profile, electrocardiographic (ECG) changes, and biochemical parameters of patients presenting with hair dye poisoning.

Material and Methods: A prospective study of 50 indoor patients admitted to poison ward of Department of Medicine, GR Medical College and JA Group of Hospitals, Gwalior, Madhya Pradesh, India, was done from August 1, 2008, to October 30, 2009. The parameters studied in all the patients were cause of ingestion, compound involved, time elapse between ingestion and admission to the hospital, duration of hospital stay, need for assisted ventilation, and cardiac manifestations at the time of presentation and during hospital stay. Routine investigations such as renal function, liver function tests, creatinine phosphokinase (CPK) levels, and cardiac marker test (CPK-MB) were done. ECG was done for all the patients daily to observe rate, rhythm, ST/T abnormalities, conduction defects, and P-R and Q-T intervals disturbances.

Result: Of 50 patients included in the study, 38 (76%) patients were between the age group of 15–25 years, and there was a female predominance (60%); 55% of male population was from the rural area, and 93.33% female belonged to urban area. Twenty-eight (56%) patients reached hospital within 6 h of hair dye ingestion. Angioneurotic edema was the most common clinical finding. Renal functions were deranged in 38% and liver functions in 18% and CPK-MB was raised in 82% patients. ECG changes were observed in 90% patients of which ST/T changes were most common. Ten (20%) patients died in this study.

Conclusion: The hair dye poisoning is not so uncommon and is associated with effects on vital organs resulting in derangements of renal, hepatic and cardiac functions. Angioneurotic edema and myocarditis can be fatal. ECG changes and elevated CPK-MB are found in majority of the patients.

KEY WORDS: Hair dye, paraphenylenediamine, PPD, myocarditis, angioneurotic edema

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Introduction

Suicide is one of the preventable public health problems, resulting in 1 million human deaths each year worldwide.^[1] It has increased by 60% over the last 50 years, mainly in developing countries like India.^[1] For suicide, poisoning is thought to be a desired method and it is a chief problem faced in emergency department of any hospital.^[2] The calculated

cumulative risk of death before the age of 80 years owing to suicide is high in South India, with male population showing a risk of 3.5% and female population a risk of 1.8%.^[3,4]

Poisoning with paraphenylenediamine (PPD)-containing hair dye is emerging as a new way of deliberate self-harm in various developing countries of Asia and Africa, and it is accompanied with high human death rate.^[2,5]

PPD is mostly found in "kala pathar."^[2] For making hair dye, it is crushed and mixed with henna to improve its color.^[2] It is a good donor of hydrogen molecules and metabolized by cytochrome P450 peroxidase to an active radical, forming a reactive compound called benzoquinone diamine.^[2] Clinical reports have shown that contact with PPD leads to irritation of skin, dermatitis, arthritis, asthma, conjunctivitis, chemosis, exophthalmos, lacrimation, and even permanent blindness. Toxicity mainly occurs by oral ingestion or percutaneous exposure.^[6]

Myocarditis owing to hair dye poisoning is fatal and sometimes neglected complication.^[7] Oral ingestion of PPD in doses exceeding 10 g can result in extensive myocardial damage, which can lead to reduction in blood pressure, lethal life-threatening arrhythmias such as ventricular tachycardia (VT), or ventricular fibrillation.^[7]

Echocardiography (ECG) shows different changes in the form of sinus tachycardia, bundle branch blocks, intraventricular conduction defect, atrial and ventricular premature complexes, atrial fibrillation, ventricular tachyarrhythmia, ST segment elevation or depression, and T wave inversion.^[7] Cardiac biomarkers such as troponin T/I (>0.1 ng/mL), and creatinine phosphokinase isoenzyme-MB fraction (CPK-MB) are elevated in many cases.^[7]

Materials and Methods

This was a prospective study of 50 patients admitted with history of hair dye (PPD) poisoning, admitted in Poison Ward of Department of Medicine, GR Medical College and JA Group of Hospitals, Gwalior, Madhya Pradesh, India, between August 1, 2008, and October 30, 2009.

All these patients showed a history of alleged ingestion of hair dye containing PPD and were of different age groups. A detailed history of amount and time of ingestion, complaint of breathlessness, difficulty in swallowing, swelling over neck and lips, and reduction in urine output was taken. All the patients underwent routine investigations such as complete blood profile, random blood sugar, renal function tests, liver function tests (LFTs), serum electrolytes, CPK levels, and cardiac marker test (CPK-MB). These were repeated at regular intervals and as indicated. Patients with preexisting morbid medical diseases such as cardiac, renal, and hepatic disorders were excluded.

Other parameters such as cause of ingestion, time elapse between ingestion and admission to the hospital, duration of hospital stay, need for assisted ventilation, and cardiac manifestations at the time of presentation and during the hospital stay were recorded in the predesigned pro forma.

Table 1: ECG findings of acute hair dye poisoning

Manifestation	Number (%)
Normal	5 (10)
ST-T change	21 (42)
Bundle branch block	4 (8)
AV Block	7 (14)
Bundle branch with AV block	2 (4)
Arterial fibrillation	3 (6)
Arterial flutter	2 (4)
Ventricular tachycardia	1 (2)
APC	1 (2)
EAT	1 (2)
Ventricular ectopic	1 (2)
Supraventricular tachycardia	1 (2)
VPC	1 (2)
Total	50 (100)

ST-T, ST and T wave; AV, atrioventricular; APC, atrial premature complexes; EAT, ectopic atrial tachycardia; VPC, ventricular premature complexes; ECG, electrocardiographic.

ECG of all the patients was done daily and repeated as required to observe rate, rhythm, ST/T abnormalities, conduction defects, and P-R and Q-T intervals measurements.

All the patients were managed in the poisoning ward with symptomatic and supportive therapy including adequate hydration, inotropic support, steroids, endotracheal intubation, tracheostomy and renal replacement therapy, and ventilator support if needed.

Results

A total of 639 patients with a history of poisoning were admitted to the Poisoning Ward between August 2008 and October 2009. Among different types of poisoning, 50 (7.82%) patients were of hair dye poisoning. Of these 50 patients, 38 were between the age group of 15–25 years, and there was a female predominance (60%).

Fifty-five of male subjects were from the rural area, and 93.33% female subjects belonged to urban area. Of 30 female hair dye poisoning patients, 27 (90%) were housewives and 3 (10%) students, while, of 20 male hair dye poisoning patients, 13 (65%) patients were in jobs and 7 (35%) students.

Educational status of the patients showed that 27 (54%) were educated up to intermediate pass, 11 (22%) to graduation, and 3 (6%) to postgraduation, and 9 (18%) were illiterate.

It was also observed that 56% patients were admitted to hospital within 6 h of hair dye ingestion, 30% patients were admitted between 6 and 12 h, and 14% reached hospital after 12 h of poisoning. In clinical presentation, 21 patients showed angioneurotic edema, and 19 patients showed decreased urine output. Twelve patients underwent tracheostomy. The ECG changes were seen in 45 (90%) of patients [Tables 1 and 2].

Table 2: Distribution of various ST-T changes

S. No	Name	No. of patients (%)
1	ST segment elevation	10 (47.61)
2	ST segment depression	3 (14.28)
3	ST segment elevation with T wave inversion	1 (4.76)
4	ST segment elevation with AV block and bundle branch block	2 (9.52)
5	ST segment depression with AV block and bundle branch block	1 (4.76)
6	ST segment elevation with ST segment depression	3 (14.28)
7	T wave inversion	1 (4.76)

AV, atrioventricular.

Table 3: Various parameters in expired patients owing to hair dye poisoning

Case	Delay in bringing (h)	ARF	CPK-MB (0–25 U/L)	ECG findings
1	7	No	910	Atrial fibrillation
2	7	No	228	Ventricular tachycardia
3	9	No	878	ST elevation in the inferior leads
4	24	No	94	Sinus rhythm with normally conducted APCs (2nd, 5th, 9th, and 14th ORS complexes in the rhythm strip)
5	3.5	No	2868	ST elevation in leads II, III, aVF and leads V2–V6
6	3	No	22	Normal ECG
7	4	No	84	ST segment elevation in the anterior leads
8	13	No	84	ST segment elevation in leads I, II and AVL, V2–V6
9	8	No	92	ST segment elevation in leads II, III, aVF, and V3–V6
10	4	No	140	Atrial flutter

CPK-MB, creatinine phosphokinase isoenzyme-MB fraction; ARF, acute renal failure.

Of 19 patients with impaired renal functions, which was confirmed by blood urea and serum creatinine, 7 patients showed impaired RFT within 24 h, 8 patients in-between 24 and 48 h and 5 patients deranged renal parameters after 48 h.

Blood urea and serum creatinine levels were significantly ($p = 0.001$) increased in hair dye poisoning patients. In patients who showed impaired hepatic profile (9), one patient showed deranged LFT between 24 and 48 h, 3 each in-between 48–72 h and 72–96 h, while 2 patients exhibited it after 96 h of admission.

Of 50 patients, CPK-MB level was significantly high in 41 patients, and it was more marked in patients with hypotension. Of 50 patients of hair dye poisoning, 10 (20%) expired owing to different cardiac reasons [Table 3]. Tracheostomy was required in all these patients.

Discussion

Hair dye poisoning cases are increasing day-by-day owing to easy availability and lower cost.^[2] Of 50 cases, 60% were female subjects of young age, who presented late to the hospital. Similar study done by Balasubramanian et al.^[5] showed that hair dye poisoning is more common in female subjects and more in the age group of 20–30 years. Hair dye

is known to cause angioneurotic edema, acute renal failure (ARF), and cardiotoxicity.^[7] This study confirmed these presentations. The angioneurotic edema was less when compared with that seen in the study by Hasim et al.^[9]; it may be because of the difference in amount of substance ingested or earlier presentation as 28 patients were hospitalized within 6 h of ingestion.

Acute poisoning causes rhabdomyolysis and ARF resulting in death if not treated aggressively.^[5] Renal functions showed derangement in our 38% of patients. In this study, hepatotoxicity was more when compared with a previous study.^[6] Hair dye is a potent cardio toxin and its ingestion leads to myocardial damage. Owing to myocardial damage, there is release of cardiac specific markers such as Trop T, Trop I, and CPK-MB.^[3] In this study, CPK-MB was found to be elevated in 82% patients. The ECG in myocarditis shows transient changes, which are usually nonspecific and occur in many other cardiac diseases; 90% of our patients showed one or other ECG changes varying from ST-T changes to VT. The mortality in our study was 20%, which is similar to other workers.^[2]

Our study has very well documented the hepatotoxicity, nephrotoxicity, and cardiotoxicity of hair dye poisoning. However, the limitation of our study is the small subject population.

Conclusion

The hair dye poisoning is becoming a common suicidal poisoning. Its effect on the vital organs is responsible for morbidity and mortality. The ECG manifestations in hair dye poisoning have been previously reported but not very frequently. In spite of best of the treatment in form of tracheostomy, endotracheal intubation with or without assisted ventilation, and dialysis for renal failure, mortality remains high in hair dye (PPD) poisoning.

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