

## STUDY TO EVALUATE THE ACUTE KIDNEY INJURY IN PATIENTS WITH POISONING

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## ABSTRACT

**Objective:** The goal of the study is to determine the pattern of dangerous material presence in the field, as well as how severely it affects kidney function and can result in death.

**Methods:** An observational study of patients hospitalized to the poison ward of tertiary care hospitals of Gwalior was planned. For data collection a structured questionnaire was used, which includes questions on demographic information, details of poisoned intake, and the time interval between ingestion and hospital admission.

**Results:** There are 79 instances of Celphos poisoning, 157 cases of organophosphorus poisoning, 67 cases of hair dye poisoning, 58 cases of rat killer poisoning, 51 cases of acid or alkali ingestion, 28 cases of alcohol intoxication, and 14 cases of Ethylene dibromide poisoning. Organophosphorus poisoning has the highest number of instances (157), whereas ethylene dibromide poisoning has the lowest number (14). Except in the situations of acid/alkali ingestion and ethylene dibromide ingestion, where the age range of 26–40 years was more involved, the majority of serious cases were in the 10–25 year old age group. Poisonings show male dominance over female dominance. Almost all poisonings result in a deranged renal profile; however, ethylene bromide poisoning has the greatest rate (21.4%), whereas celphos poisoning has the highest rate (28.37%) in terms of term mortality.

**Conclusion:** The findings show that organophosphorus toxicity, celphos poisoning, hair dye, and rat killer are all prevalent in Gwalior and the nearby region. Acute kidney damage was also detected in hair dye, celphos, organophosphorus, rat killer, and ethylene dibromide poisonings, with ethylene dibromide being the most common. Finally, celphos and Ethylene dibromide poisoning had the greatest fatality rates.

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## INTRODUCTION

Poison is any substance that can kill, damage, or impede normal physiologic function in people. Poison control training and research centers have sprung up all over the world in the past 50 years to help with poisoning management. These facilities also focus on poisoning prevention [1]. Poisoning is a global issue. Due to a lack of a central registry, the actual prevalence of poisoning in India is unknown; however, it is estimated to account for 10% of all medical emergency admissions. Suicide is the third highest cause of mortality among those aged 15–44. In the 1990s, it was responsible for around 600,000 fatalities. Because of the toxicity of accessible toxins and a lack of medical services, mortality in poor nations is higher than in developed countries. Ingestion or exposure to pesticides and insecticides containing organophosphorus chemicals is the most prevalent poisoning. Aluminum phosphide, a grain preservative, is often reported toxicity in North, Northwest, and Central India. Suicide poisoning was the most common cause of death in North India throughout the 1990s. Hair dye poisoning is characterized by angioneurotic edema with airway obstruction, rhabdomyolysis with dark urine, and abrupt renal failure [1].

Every year, almost 5 million people in the United States are treated for drug exposure. Only approximately 5% of patients need to be admitted to the hospital. The overall death rate is minimal, at 0.03% of all exposures, while suicidal patients have a fatality rate of 1–3%. In India, acute toxicity represents for 2–3% of all hospital admissions. The high prevalence in the population is due to the presence of insecticides and herbicides, as well as the stress of contemporary living. The most common poisons found in India include pesticides, vegetable poisons, aluminum phosphide, alcohol, hypnotics, and sedatives. Insecticides, pesticides, and vegetable poison are commonly used in rural regions,

whereas sedatives and other medication over dosage are commonly used in cities and towns. In India, the statistics are substantially higher, and they are steadily rising [2,4].

Under the mode of action, the poisons are classified in corrosive, irritant, neurotic, cardiac, asphyxiant, and miscellaneous category [2,4]. Moreover, the effect of poison on body could be altered by various factors such as dose – smaller or toxic dose; form of poison – physical state, chemical combination or mechanical combination; mode of administration – orally swallowed, inhaled, intravenous, intramuscular or subcutaneous ingestion; and finally the condition of the body – age and duration of sleep [1,2,4].

Vomiting and diarrhea eliminate the majority of a toxin from the body. The toxin is more usually bio transformed in the liver. The urinary system is the primary pathway for the toxin or its final product to be excreted. Bile ducts, sweat glands, saliva, mucus, and the lungs are some of the other pathways. Inorganic toxins such as arsenic are retained in the epidermis, hair, and nails. Lead and radioactive metals are stored in the bones [1,2,4,5]. In a case of poisoning, the diagnosis may be determined based on the history, physical examination, laboratory assessment – anion, osmolar, and arterial blood oxygen gap, and toxicological screening [3,4,6-8].

Numerous poisons such as organophosphorus poisoning paraquat poisoning, hair dye poisoning, aluminum phosphide or celphos poisoning, acetaminophen poisoning, zinc phosphide (rat killer), methanol poisoning, copper sulfate poisoning, and ethylene dibromide can affect the kidney function variably and leads to higher chances of mortality. The study is envisaged to explore the pattern of presence of poisonous substance in the field and how severely it effects the renal function.

## METHODS

From March 2012 to November 2013, this study was conducted in a tertiary care hospital of Gwalior. On admission, a standardized questionnaire was completed, which included demographic information as well as specific questions regarding the poison intake and the time from ingestion to hospital attendance. The preliminary investigation on admission such as blood creatinine levels, blood urea levels, and urine output check were conducted as mandatory. All the patients who were having the history of poison ingestion are included in the study except those who were not given the consent, caring history of unknown substance ingestion, those left against medical advice within a day or two of admission, homicidal, mass poisoning, known case of chronic kidney disease, and acute kidney disease due to any cause.

The study has conducted with an aim to find the proportion of the poisonous cases in the identified set up and its impact on the renal function. To address the aim of the study two objective have been identified – First, to study the frequency of various poisons and second, to identify the acute kidney injury caused by various poisons. Study was approved by the institutional ethics committee. Written informed consent of all the participants have been collected before conducting the study.

## RESULTS

All the patients covered under the study were examined thoroughly with special attention to consciousness, pulse, blood pressure, and respiratory rate (vitals). After gastric lavage, the electrocardiogram was recorded in all the patients and blood has drawn simultaneously and sent for examination. In addition to these, CPK MB, SGOT, SGPT, urea, and creatinine were also completed in the sample population. Patient was managed as per the standard protocol of hospital's intensive care unit. Line of management is supportive and symptomatic in majority of the cases. Need base antidote prescription has also been performed.

Table 1 is showing the information regarding the age distribution of the involved cases. The total cases in Celphos are 79, in organophosphorus poisoning are 157, in hair dye poisoning are 67, in rat killer poisoning are 58, in acid or alkali ingestion are 51, in alcohol intoxication are 28, and in ethylene dibromide are 14. Highest number of the cases is found in the organophosphorus poisoning, that is, 157 while lowest one is 14 of ethylene dibromide ingestion. Except in acid/alkali ingestion and ethylene dibromide ingestion, where age range of 26–40 years was more engaged, the majority of dangerous cases belong to young age groups, that is, 10–25 years. In celphos cases, it is 58.1% (46 cases); however,

52.2% (82 cases) in organophosphorus poisoning, 64% (43 cases) in hair dye poisoning, 48.3% (28 cases) in rat killer poisoning and about half of cases (14 cases) of alcohol intoxication are from 10 to 25 years of the age group.

Likewise, Table 2 is presenting the data about the sex distribution of the sample and male predominancy over female is evident in all the poisonings. In the celphos poisoning, the male dominancy is of 67.1% (53), 63.1% (99 cases) in organophosphorus poisoning, 58.2% (39 cases) in hair dye ingestion, 62.1% (36 cases) in rat killer ingestion, 51% (26 cases) in acid or alkali ingestion, 93% (51 cases of 28) in alcohol intoxication, and 78.6% (11 cases) in ethylene dibromide ingestion. On other hand, in female, the celphos poisoning is of 32.9% (26), 37% (58 cases) in organophosphorus poisoning, 41.7% (28 cases) in hair dye ingestion, 37.9% (22 cases) in rat killer ingestion, 49% (25 cases) in acid or alkali ingestion, 7.2% (2 cases) in alcohol intoxication, and 21.4% (3 cases) in ethylene dibromide ingestion.

Table 3 is depicting the distribution of the poisoned cases with deranged renal profile. By analyzing the table, it is evident that there is higher chances of ethylene dibromide poisoning on the renal function as it contain the high proportion of the unfavorable renal profile case than any other poisons. However, renal derangement is more pronounced in celphos, hair dye, and ethylene dibromide poisoning. Moreover, in celphos poisoning 14 patients (17.72%) are having deranged renal profile, in the hair dye poisoning, it is 12 patients (17.91%), in the organophosphorus, 15 patients (9.55%), and in the rat killer poisoning 5 patients (8.62%) are facing the kidney related issues. Finally, the p value has found significant in two positioning, that is, in celphos and in hair dye poisoning and they are 0.049 and 0.050, respectively.

Table 4 is showing the impact of the poisoning the health through the number of the mortality occurred during the given period. Maximum mortality is seen in celphos poisoning 28.37%, and ethylene dibromide in 14.28%. Moreover, the mortality in celphos poisoning is 20 patients (20%), in the hair dye poisoning, it is 3 patients (4.47%), in the organophosphorus, 5 patients (3.18%), in the rat killer poisoning 2 patients (3.44%), and in ethylene bromide it is 2 (14.28%).

## DISCUSSION

The present study was undertaken on 500 patients admitted in the poison wards from March 2012 to Nov. 2013. Hair color is an emulsion (oil) based hair dye that is widely used in India. Hair dye has been reported to be used as a suicide aid. Twelve individuals (17.91%) had renal derangement out of the 67 cases of hair color ingestion, with the

**Table 1: Age distribution of poisoning**

	Celphos poisoning		Organophosphorus poisoning		Hair dye poisoning		Rat killer poisoning		Acid/alkali ingestion		Alcohol intoxication		Ethylene dibromide ingestion	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Age group (in years)														
10–25	46	58.1	82	52.2	43	64.0	28	48.3	19	37.3	14	50.0	3	21.4
26–40	27	34	53	33.4	20	29.9	20	34.5	20	39.2	11	39.3	6	42.9
41–55	6	7.59	20	12.7	3	4.5	6	10.3	7	13.7	3	10.7	3	21.4
56 and above	0	0	0	0.0	1	1.5	4	6.9	5	9.8	0	0.0	2	14.2
Total	79	100	157	100	67	100	58	100	51	100	28	100	14	100

**Table 2: Sex distribution of poisoning**

	Celphos poisoning		Organophosphorus poisoning		Hair dye poisoning		Rat killer poisoning		Acid/alkali ingestion		Alcohol intoxication		Ethylene dibromide ingestion	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Gender														
Male	53	67.1	99	63.1	39	58.2	36	62.1	26	51.0	26	92.9	11	78.6
Female	26	32.9	58	37.0	28	41.7	22	37.9	25	49.0	2	7.2	3	21.4

**Table 3: Distribution of the patients in poisoning with deranged renal profile**

Type of Poisoning	Total	Deranged renal profile	Percentage
Celphos poisoning	79	14	17.7
Hair dye poisoning	67	12	17.9
Organophosphorus poisoning	157	15	9.6
Alcoholic intoxication	28	-	-
Rat killer	58	5	8.6
Acid ingestion	51	-	-
Ethylene dibromide	14	3	21.4
Sleeping pill	32	-	-
Naphthalene	2	-	-
Kerosin	4	-	-
Haratota (copper sulfate)	1	-	-
Dhatura	6	-	-
Bhang	1	-	-
Total	500	-	-

**Table 4: Mortality of the patients in poisoning**

Type of Poisoning	Total	Mortality	Percentage
Celphos poisoning	79	20	28.37
Hair dye poisoning	67	3	4.47
Organophosphorus poisoning	157	5	3.18
Alcoholic intoxication	28	-	-
Rat killer	58	2	3.44
Acid ingestion	51	-	-
Ethylene dibromide	14	2	14.28
Sleeping pill	32	-	-
Naphthalene	2	-	-
Kerosin	4	-	-
Haratota (copper sulfate)	1	-	-
Dhatura	6	-	-
Bhang	1	-	-
Total	500	32	-

majority of patients being between the ages of 10 and 25. This number is more than half of the cases identified in the study of Kallel *et al.*, which is 47.7%. In hair dye poisoning number of males patients are more than females [9]. Oliguria and fluid overload which is represented by the edema over the face are the visible symptoms which has found in the study. In a study by Ram *et al.* physical manifestations include cervical and upper respiratory tract edema, muscle edema, rhabdomyolysis, and oliguric acute kidney infection (AKI), while in another study by Ashar, symptoms include angioedema of the face and neck with difficulty breathing, secondary to the upper respiratory tract edema, and chocolate brown urine, confirming evidence of hair dye poisoning [10,11].

Aluminum phosphate, often known as celphos, is a highly poisonous rodenticide that releases the phosphine gas - PH<sub>3</sub> when exposed to moisture. This gas is easily absorbed through inhalation, ingestion, or cutaneous contact. In the present study, there are 79 patients of the celphos are present out of that total 14 (17.72%) patients who have a deranged renal profile. Not only, the male to female ratio is 2:1, but the majority of participants are also fall under the age group of 10 and 25 years. The prominent symptoms found in the study are, nausea, vomiting, and oliguria in 71.42% cases while in another study of Shadnia *et al.* where the metabolic acidosis has evidenced in 42% of cases which ultimately end up to AKI or chronic kidney infection with a significant oliguria [12]. Also in the study by Chug acute renal failure, metabolic acidosis has often been reported. The mortality rate of 28.37% in the study is similar to that of mentioned in the study from Tehran 2000–2007, that is, 31% [13,14].

The study shows 58 patients of rat killer ingestion out of which the 5 (8.62%) patients had renal injury. The clinical signs and symptoms of zinc phosphide poisoning are also identical to those of aluminum

phosphide poisoning; however, the onset is delayed. The majority of patients who are poisoned with rat killer (zinc phosphite) are between the age group of 10 and 25 years. Males are outnumbered than females when it comes to hair rat killer poisoning (zinc phosphide).

The study illustrates that the nausea (98%) and vomiting (80%) are early features after ingestion which is in accordance with the study of Chug *et al.* According to which profuse vomiting, abdominal pain, palpitation, sweating, tachypnea, and dyspnea are the most common presenting features [15]. Moreover, 8.62% are suffering from renal injury and the similar findings have seen in study by Chug *et al.* 1998, where the unusual complication of phosphide ingestion including acute renal failure rhabdomyolysis, pleural effusion, hemorrhage, and necrosis are also evident [15].

The study presents 28 patients are suffering from alcohol intoxication with the male: female ratio 13:1. Out of these 28 patients, 22 patients are presented with the complaint of nausea and vomiting. The majority of individuals with alcohol intoxication are between the ages of 10 and 25. Males are more likely than females to suffer from alcohol intoxication. The kidney is not commonly considered a key target unit in methanol poisoning, according to Closs and Solberg [16].

Ingestion of ethylene dibromide causes significant alterations in important organs such as the kidney and liver. Oxidation of ethylene dibromide by cytochrome P450 produces 2 bromoacetaldehyde, which is responsible for ethylene dibromide's acute toxicity. The study shows total 14 patients were admitted out of which 3 (21.42%) patients are having renal derangement. All the patients are presented with the complaint of nausea and vomiting. Similar results have been found in other studies as well. Raman and Stain documented the clinical profile of eight individuals, two of whom had circulatory failure, one of whom acquired kidney failure and expired within 24 h, and the other five of whom had liver injury [17]. According to Singh *et al.*, after ingesting ethylene dibromide, the patient experienced giddiness, vomiting, and reduced urine production [18]. The majority of individuals treated with ethylene dibromide are between the age of 25 and 40 years. The number of male patients treated with ethylene dibromide is higher than the number of female patients.

## CONCLUSION

The present study shows that the most common poisoning in patients was organophosphorus, followed by celphos poisoning, hair dye, and rat killer. Moreover, the AKI was found in poisonings of hair dye, celphos, organophosphorus, rat killer, and in ethylene dibromide. The incidence of renal injury is much higher in ethylene dibromide than others. Finally, the highest mortality was noted in poisonings of celphos and of ethylene dibromide.

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## AUTHORS CONTRIBUTION

Dharmendra Kataria contributed to conceptualization, design, write up, and analysis of study, Mukesh Singh Tomar contributed to conceptualization, design, data collection, write up and analysis of study, and Kailash Charel contributed to review and analysis of study.

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## CONFLICTS OF INTEREST

None.

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