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Original Research Article

A Descriptive Study on Demographical, Haematological and Biochemical Profile of Weedicide Poisoning At Tertiary Health Care Centre, Chhindwara, MP

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Conflict of interest: Nil

Abstract:

Background: The issue of poisoning caused by pesticides and various other chemicals used in agriculture is a significant public health concern on a global scale, particularly in developing nations. Among the many substances, weedicide like as paraquat, 2,4-D, and glyphosate have been identified as significant contributors to elevated rates of illness and death. There are limited publications on weedicide poisoning.

Aims and Objective: To study the Demographical, Haematological and Biochemical Profile of Weedicide Poisoning.

Materials and Methods: The present study is a retrospective observational research that includes patients who were hospitalised to CIMS Hospital Chhindwara due to weedicide poisoning between October 2019 and November 2020. The researchers gathered data on demographic characteristics, clinical presentations, haematological parameters, and biochemical markers from the patients' medical records.

Result: Total number of weedicide poisoning were 28 out of which paraquat cases were 19(67.86%), 2,4-D 7(25%) and glyphosate 2(7.14%). Outcome wise, 10 (35.74%) of them discharged, 6(21.43%) of them expired, 12(42.86%) referred to higher centre for haemodialysis/hemoperfusion and 1(3.57%) absconded.

Conclusion: The ingestion of weedicide has been found to be linked to significant morbidity and fatality rates. The prompt emphasises the need of promptly identifying and implementing proactive measures to address cases of weedicide poisoning, given the absence of a targeted antidote.

Keywords: Weedicide, 2-4-D, Paraquat, Glyphosate, Poisoning.

Introduction

The issue of poisoning caused by pesticides along with other chemical substances used in agriculture is a significant public health concern on a global scale, particularly in developing nations. The annual mortality rate resulting from hazardous exposure is anticipated to exceed 50,000 individuals. Based on data from the National Poisons Information Centre in New Delhi, an examination of reported cases of poisoning revealed that the most prevalent instances of poisoning were attributed to household agents (44.1%), subsequently followed by pharmaceutical drugs (18.8%), agricultural pesticides (specifically weedicide) (12.8%), chemical substances used in industry (8.9%), bites by animals and stings (4.7%), plants (1.7%), cases of unknown origin (2.9%), and miscellaneous categories (5.6%). [4]

A wide variety of home items frequently employed for domestic applications encompass insecticides, household cleansers, thermometer mercury, antiseptic medications, kerosene, paint thinners and so forth. In the event of improper usage or mishandling, these substances have the potential to induce poisoning. The All India Institute of Medical Sciences in New Delhi houses the National Poisons Centre (NPIC), which serves as a resource for treating physicians across India by offering guidance on the appropriate care of poisoning cases. Globally, the incidence of deaths resulting from poisoning by pesticides & chemical substances used in agriculture is estimated to be over 20,000 per year, with over 2 million hospitalisations reported annually. Paraquat poisoning constituted a mere 0.34% of the total reported cases, although it exhibited the greatest fatality rate, contributing to 13% of all recorded deaths. [3] As agriculture is the main occupation of the people living at Chhindwara, there is widespread use of pesticides and weedicides. Weedicides are chemicals used to control undesirable vegetation.

Common weedicides used at Chhindwara district are 2-4-D amine salt 58%, Glyphosate (Glycine) 41%, paraquat (safaya) 24%, metribuzin 70% WP, phenoxaprop-p-ethyl 9.3%, propaquizafop10% EC, tembotrione 34.4%, sodium acifluorfen 16.5% + clodinafop-propargyl 8% EC, Topramezone. It is due to easy availability, weedicides are commonly used poison at Chhindwara district. 2, 4-D is categorised as a Chlorophenoxy herbicide based on its chemical composition. It has an impact on several physiological systems, including the heart, the central and peripheral neurological systems, liver, kidneys, muscles, lungs, and endocrine system.

The symptoms associated with intoxication encompass a range of physiological manifestations, such as nausea, vomiting, stomach pain, hepatic injury, damage to the kidneys, hypertonia, areflexia, suppression of the central nervous system, fasciculations, coma, hypotension, and electrocardiogram abnormalities [6]. Ingesting a significant amount of 2,4-D might potentially result in deadly acute toxicity [7]. A range of harmful processes can be observed in these substances, such as cell membrane damage that is depending on the dosage, disruption of acetyl coenzyme A metabolism, and uncoupling of oxidative phosphorylation. There is currently no known particular antidote available for the poisoning caused by the herbicide 2,4-D [8].

In instances of severe poisoning, it is advisable to contemplate the implementation of alkaline diuresis or haemodialysis as means to enhance the removal of herbicides. [8] Paraquat (1, 1-dimethyl-4, 4-bipyridium dichloride) ingestion is a major cause of fatal poisoning in many parts of Asia and Pacific nations [9]. It is a broad spectrum non-selective herbicide which acts on contact, destroys the unwanted green plants by the formation of superoxide anion during photosynthesis. [10] Paraquat interferes with the intracellular electron transfer systems, thus inhibiting the reduction of NADP to NADPH. This will then result in the accumulation of superoxide radical which causes destruction of lipid cell membranes. [11] The production of oxygen and nitrogen species that are highly reactive leads to organ damage, with the lungs being particularly susceptible due to their uptake against a concentration gradient. [12]

There is a lack of specific antidotes and the existing therapies have not demonstrated efficacy in managing severe fulminant PQ poisoning. [13] Glyphosate is a non-selective herbicide available as five different salts and its commercial formulations contain surfactants, which vary in nature and concentration. As a result, human poisoning with this herbicide is not with the active ingredient alone but with complex and variable mixtures. [14] The mechanism of toxicity of glyphosate in mammals is thought to be uncoupling of oxidative phosphorylation.[15] .

The ingestion of this substance leads to erosion of the GI system, resulting in challenges with swallowing and gastrointestinal bleeding. Dermal exposure has been sporadically associated with instances of eye and skin irritation. The act of inhaling spray mist has the potential to induce pain in the oral and nasal regions, as well as provoke tingling sensations and irritation in the throat. Severe poisoning can result in several physiological manifestations, including dehydration, hypotension, oliguria, pneumonitis, altered state of consciousness, dysfunction of the liver, acidosis, hyperkalaemia, and dysrhythmias. [16]

There is no antidote for Glyphosate and treatment is supportive. Majority of the studies was done on pesticide poisoning in general population. only few of the studies have been published on weedicide poisoning, hence this study was aimed at assess the weedicide poisoning among the general population particularly on demographical, haematological, biochemical profile and their outcome.

Aims and Objective:

To study the Demographical, Haematological and Biochemical Profile of Weedicide Poisoning.

Materials and Methods:

Institutional Research and Ethical Committee approval of Chhindwara Institute of medical Sciences, Chhindwara, M.P was obtained before starting the study.

It was a hospital-based, retrospective observational study in carried out among patients diagnosed with weedicide poisoning were admitted in the Department of Medicine, CIMS Hospital Chhindwara, during October 2019 to November 2020 were included. The demographic, clinical, haematological and biochemical findings of the included patients were collected from the case records obtained from medical record department.

The haematological and biochemical investigations analysed on the third day of admission. The recorded information's were entered in the proforma.

Inclusion criteria:

- Patients admitted with history of weedicide ingestion.

Exclusion criteria:

- Patient with history of chronic kidney disease and chronic liver disease.
- Patients with history of medications effecting liver function and renal function tests.

Statistical analysis: The data obtained were entered in a Microsoft excel sheet and analysed

using SPSS software. The association was analysed using frequency analysis, percentage analysis.

Result

During the designated research period, a total of 28 individuals who had been diagnosed with weedicide toxicity were selected as participants for the study.

The weedicides that were swallowed include 19 of paraquat, 7 cases of 2-4D and 2 of glyphosate. (Table 1) displays the frequency distribution of various weedicide ingestions.

Table 1: Frequency distribution of weedicide compounds ingested.

Type of weedicide	Paraquat (safaya)	2,4-D	Glyphosate (glysine)	Total
Number of cases (percentage)	19 (67.86%)	7 (25%)	2 (7.14%)	28 (100%)

In every case, all patients intentionally ingested the poison orally, making it the prevailing form of poisoning (100%). The distribution of patients by gender revealed that the majority of individuals in the research population were male, accounting for 85.71% of the total.

The sample consisted of 24 male patients and 4 female patients, resulting in a male-to-female ratio of around 6:1. The researchers determined that the average age of the participants in the study was 31±11 years.The study revealed that the majority of instances (35.71%) fell within the 15–25 years age group, while an equal proportion (35.7%) were seen in the 26-35 years age group. Subsequently, the 36 to 45 years age range accounted for 21.43% of cases, with the 46-55 & 56-65 years age groups each representing 3.57% of the total patient population. (Table 2)

Table 2: Gender distribution among various age groups of all the weedicide poisoning patients

S. No.	Age Group (in yrs.)	Male (n=24)	Female (n=4)	Total (n=28)
1.	15-25	9	1	10
2.	26-35	9	1	10
3.	36-45	5	1	6
4.	46-55	1	0	1
5.	56-65	0	1	1

The majority of the research's participant population consisted of farmers 13 (46.43%), followed by students 4 (14.28%), and housewives 4 (14.28%) then followed by coolie 3 (10.71%) and unemployed 3 (10.71%) and followed by private employee 1 (3.57%).

Weedicide poisoning patients presented with complains of vomiting 28 (100%), oral ulcers 27 (96.43%), throat discomfort 26 (92.86%), abdominal pain 19 (67.86%), dysphagia 23 (82.14%) hematemesis 1 (3.57%) melena 1 (3.57%) and dyspnoea 1 (3.57%). (Table 3)

Table 3: Distribution of study population according to weedicide poison ingested and symptoms

Symptoms	Paraquat (n=19)	2-4-D (n=7)	Glyphosate (n=2)	Total
Vomiting	19	7	2	28 (100%)
Oral ulcer	19	7	1	27 (96.43%)
Throat discomfort	19	6	1	26 (92.86%)
Abdominal pain	17	2	0	19 (67.86)
Dysphagia	19	3	1	23 (82.14%)
Hematemesis	1	0	0	1 (3.57%)
Malena	1	0	0	1 (3.57%)
Dyspnoea	1	0	0	1 (3.57%)

Among the study population, 17 % of patients had developed multi-organ failure. TLC was markedly raised in paraquat cases mean was 22186.37±4646.40. In 2,4-D mean TLC was 9466.71±1720.41 and in glyphosate it was 11057±1099.55. In paraquat cases serum bilirubin was raised mean 3.33±1.01, SGOT was raised mean 198.02±58.54, SGPT was raised mean 115.60±25.75 blood urea was raised mean 129.14±43.93, serum creatinine was raised 6.57±2.31. In 2,4-D cases mean serum bilirubin 0.98±0.40, mean SGOT was 35.21±18.56, mean SGPT was 30.76±13.72, mean blood urea was 28.09±2.61, serum creatinine was raised 1.22±0.17.

In glyphosate cases mean serum bilirubin was 1.22±0.22, mean SGOT was 49.5±6.36, mean SGPT 40.2±3.11, mean blood urea was raised 38±8.49, mean serum creatinine was 1.45±0.70. (Table 4)

Table 4: Distribution of study population according to ingested poison and laboratory investigations (N = 28)

Parameters	Paraq (N=19)	2-4-D (N=7)	Glyphosate (N=2)
Haemoglobin (gm/dl)	12.36±1.66	12.83±0.433	12.16±3.03
TLC	22186.37±4646.40	16466.71±1583.92	11057.5±1099.56
Platelet	2.17±0.51	2.17±0.34	2.20±0.23
T. Bilirubin (mg/dl)	3.33±1.01	0.98±0.40	1.22±0.22
SGOT (U/L)	198.02±58.54	35.21±18.56	49.5±6.36
SGPT (U/L)	115.60±25.75	30.76±13.72	40.2±3.11
Blood Urea (mg/dl)	129.14±43.93	28.09±2.61	38±8.49
S. Creatinine (mg/dl)	6.57±2.31	1.22±0.17	1.45±0.70
ECG (AF)	1	0	0

The outcome of weedicide poisoning cases admitted during study period were 10 (35.74%) of them discharged, 6 (21.43%) of them were expired, 12 (42.86%) referred to higher centre for haemodialysis / haemoperfusion and 1(3.57%) of them absconded. (Table No 5)

Table 5: Outcome in different weedicide poisonings

Outcome	Paraquat (n=19)	2,4-D (n=7)	Glyphosate (n=2)	Total
Discharge	1	6	2	9
Expired	6	0	0	6
Referred to higher centre	11	1	0	12
Absconded	1	0	0	1

Discussion

Weedicide poisoning is identified as a prevalent form of suicide in the region of Chhindwara, exhibiting significant morbidity and fatality rates. Paraquat, 2,4-D, & glyphosate are the most often encountered poisons in cases of weedicide poisoning. The aforementioned chemicals exhibit a high degree of toxicity, necessitating the use of appropriate treatment strategies for cases of poisoning. These patients have a high death rate mostly because to the intrinsic toxicity of the condition and the absence of efficacious therapeutic options. Typical manifestations of these poisonings encompass gastrointestinal corrosive effects including the oral cavity and pharynx, epigastric discomfort and dysphagia, disturbances in acid-base equilibrium, pulmonary edoema, shock, and tachycardia. The long-term health consequences encompass lung fibrosis, multi-organ failure, or mortality. There is currently no established antidote available for the treatment of these poisonings. The primary approach to treatment mostly involves providing assistance. In the first instance, it is advisable to employ gastric lavage or whole gut irrigation techniques, utilising adsorption agents such as Fuller's earth, bentonite, or activated charcoal. In the event of renal failure, the medical interventions of haemodialysis or haemoperfusion may be deemed appropriate.

In India, herbicides have been frequently employed in suicide efforts [17]. A research conducted in hospitals between 1999 and 2006 documented the cases of five patients in Punjab, three of whom died [18]. Another study conducted in Tamil Nadu recorded ten patients with a mortality rate of 100% [19]. According to a recent media report, the issue of paraquat poisoning has emerged as a significant concern in the region of Orissa, resulting in over 100 documented fatalities between the years 2018 and 2019 [20].

During the designated research period, a total of 28 incidents of weedicide poisoning were recorded. Among these cases, 19 (67.86%) were attributed to paraquat, 7 (25%) were associated with 2,4-D, and 2 (7.14%) were linked to glyphosate. The sample population exhibited a gender distribution in which men (85.71%, n=24) were predominant compared to females (14.29%, n=4). The gender distribution in the sample was characterised by a male-to-female ratio of 6:1. The average age of the participants was 31 years, with a standard deviation of 11 years. The study conducted by Harika Cherukuri et al. revealed that a significant proportion of the cases consisted of men, accounting for 60% of the research's participant population. Specifically, there were 36 male patients and 24 female patients, resulting in a male-to-female ratio of around 3:2. [17] The study population had a median age of 25.38 ±9.136 years. [17] In a research done at Soonchunhyang Hospital (SCH) in Cheonan, Korea, Kim et al. (2009) found that the male to female ratio was 1.3:1. The average age for men was 26.58 ± 9.473 years, while the average age for females was 23.58 ± 8.480 years. [21]

The common clinical manifestations of weedicide poisoning observed in our study include vomiting (100%), oral ulcers (96.43%), throat discomfort (92.86%), abdominal pain (67.86%), dysphagia (82.14%), haematemesis (3.57%), melena (3.57%), and dyspnea (3.57%). These findings are consistent with the results reported by Harika et al, who found that among 60 patients with herbicide poisoning, the

incidence of vomiting was 68.3%, oral ulcers were present in 31.7% of cases, throat discomfort in 26.7%, abdominal pain in 23.3%, dysphagia in 16.7%, and dyspnea in 10.0%. Within the examined cohort, a total of four individuals, constituting 6.7% of the study population, were found to have mental disorder. [17] The study conducted by Sandhu et al. (year) revealed that the predominant symptoms observed in cases of paraquat poisoning were vomiting, which was reported in 100% of the cases, subsequently followed by oral ulcers (59%), dysphagia (53%), and dyspnea (41%). The findings are comparable.[22]

In our study mean haemoglobin was 12.36±1.66 in paraquat, 12.83±0.433 in 2,4-D and 12.16±3.03 in glyphosate poisoning. TLC was markedly raised in paraquat cases mean was 22186.37±4646.40. In 2,4-D mean TLC was 9466.71±1720.41 and in glyphosate it was 11057±1099.55. In paraquat cases serum bilirubin was raised mean 3.33±1.01, SGOT was raised mean 198.02±58.54, SGPT was raised mean 115.60±25.75 blood urea was raised mean 129.14±43.93, serum creatinine was raised 6.57±2.31. In 2,4-D cases mean serum bilirubin 0.98±0.40, mean SGOT was 35.21±18.56, mean SGPT was 30.76±13.72, mean blood urea was 28.09±2.61, serum creatinine was raised 1.22±0.17. In glyphosate cases mean serum bilirubin was 1.22±0.22, mean SGOT was 49.5±6.36, mean SGPT 40.2±3.11, mean blood urea was raised 38±8.49, mean serum creatinine was 1.45±0.70.

Paraquat exhibits several toxic symptoms, which encompass corrosive damage to the gastrointestinal system, acute kidney injury, renal tubular necrosis, liver dysfunction and necrosis, respiratory failure, as well as pulmonary fibrosis. Paraquat poisoning is commonly associated with a high mortality rate. The mortality rates in India and several other regions throughout the globe have been shown to range from 35% to 100% [24]. The occurrence of death has been shown to potentially manifest up to duration of 6 weeks subsequent to the act of ingesting. [23].

Our study revealed that all patients with parquat poisoning exhibited leucocytosis, while 94.87% of them displayed abnormal enzyme levels in liver function tests. Additionally, 94.87% of patients exhibited laboratory values indicative of acute renal damage, and 3.57% of patients showed atrial fibrillation in electrocardiography (ECG). In terms of outcomes, 9 instances (35.74%) resulted in discharge, 6 cases (21.43%) ended in expiration, 12 cases (42.86%) were sent to a higher institution for haemodialysis / haemoperfusion, and 1 patient (3.57%) absconded. In a study conducted by Sarkar TS et al, it was observed that 64% of the patients exhibited abnormal liver enzyme levels in their liver function tests. Additionally, 58% of the patients displayed laboratory values indicative of acute kidney injury, while 30% of the patients exhibited chest X-ray characteristics suggestive of alveolar damage. Furthermore, 62% of the patients were discharged from the hospital following their recovery, whereas 38% of the patients unfortunately succumbed to their condition.[25]

To mitigate further absorption, it is recommended to provide activated charcoal along with Fuller's earth. The performance of gastric lavage should be avoided due to its potential to cause caustic damage (26). The clinical course is unlikely to be altered by the implementation of elimination procedures which include haemodialysis and haemoperfusion [26]. The procedure of immunosuppression using dexamethasone, cyclophosphamide, and methylprednisolone is commonly employed; nonetheless, the available data supporting its usefulness is notably lacking [26]. Antioxidants, like acetylcysteine and salicylate, have the potential to provide benefits due to their ability to scavenge free radicals, exhibit anti-inflammatory properties, and suppress NF-κB activity.[26]

Limitation

This study is limited to one city and one institution hence it may not be possible to generalize the results to a larger geographical region.

Conclusion

Weedicide poisoning is common in places where agriculture is the main occupation like in Chhindwara. It is associated with high morbidity and mortality The most common symptoms are vomiting, oral ulcer, throat discomfort, abdominal pain and dysphagia. Most important laboratory findings are leucocytosis, deranged LFT and deranged RFT particularly in paraquat poisoning. Weedicides especially Paraquat lead to multiorgan failure and death. It is utmost important to differentiate weedicide poisoning from insecticide poisoning in ER. Early diagnosis and aggressive management of paraquat poisoning is necessary as there is no specific antidote available.

Recommendation

It is necessary to curb the current situation that we may be facing, this can be done by conducting further studies, across various region so as to be able to properly monitor the trends which can help in passing legislative laws and action to prevent and treat the patient of such occurrences.

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