Original Research Article

A STUDY ON EPIDEMIOLOGICAL AND CLINICAL PROFILE OF ACUTE PARAQAT POISONING AND ITS CONSEQUENCES IN TERTIARY CARE CENTRE

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Abstract: Paraquat (1, 1' dimethyl-4, 4'-bipyridinium) was introduced in 1962. It is a widely used contact herbicide with a good safety record when used properly [1]. It came into disrepute because of accidental or intentional ingestion leading to a high mortality. Paraquat toxicity can produce both local and systemic effects. The major acute effects are the ulceration of skin, lips, tongue, pharynx and esophagus. The acute systemic effects are usually pulmonary edema, cardiac, renal or hepatic failure and convulsions [2]. The main objective of the study is to study the epidemiological and clinical profile of acute paraquat (PQ) poisoning and to determine the outcome in acute paraquat poisoning patients in tertiary care centre in south India. The methodology adopted for this retrospective study describing the demographic characteristics, clinical features and outcomes of paraquat poisoning cases admitted to Hassan Institute of Medical Sciences, Hassan, Karnataka, India, from 1st march 2012 to 31st march 2013. Medical records of 77 patients were reviewed. A total of 77 cases of acute paraquat poisoning were included in the study, who were admitted in the hospital during our study period. Recovery is 46.75%, mortality is 27.27% and 22% went against medical advice. This study concludes that, paraquat is a widely used weedicide by the farmers in the rural areas in and around the Hassan, suicidal ingestion is more common than occupational exposure in contrast to developed countries. Patient who has taken <20 ml and reported <6 hours shown better recovery in compared to their counter parts.

Key Words: Paraquat poisoning, PQ, Mortality.

INTRODUCTION

Acute paraquat poisoning continues to be major public health problem in our country. Paraquat (1, 1' – dimethyl-4, 4'-bipyridinium) was introduced in 1962. It is a widely used contact herbicide with a good safety record when used properly (1). It came into disrepute because of accidental or intentional ingestion leading to a high mortality. Paraquat toxicity can produce both local and systemic effects. The major acute effects are the ulceration of skin, lips, tongue, pharynx and esophagus. The acute systemic effects are usually pulmonary edema, cardiac, renal or hepatic failure and convulsions (2).

Paraquat poisoning, characterized by multi organ failure and pulmonary fibrosis with respiratory failure, is widely reported worldwide. However, the data from our country is scanty. The present study includes patients of paraquat poisoning over 1 year period.

MATERIALS AND METHODS

This retrospective study was carried out at Hassan Institute of Medical Sciences, Hassan, and Karnataka, India. This institute is a referral government hospital.

Inclusion criteria
I. All patients of paraquat poisoning aged above 15 years.
II. The diagnosis was based on the History and the verification of the ingested herbicide (brought by the attendants), clinical examination findings like mouth ulcers, skin blistering and ulceration.

Exclusion criteria
I. All patients of paraquat poisoning aged below 15 years
II. All patients who are not fulfilling second inclusion criteria.

This is a retrospective study of patients admitted to the General medicine department of Hassan Institute of Medical sciences, Hassan, Karnataka, between March 2012 to March 2013 for alleged paraquat poisoning. No personal identification data were recorded and all information obtained from the medical records was kept confidential.

Statistical methods
Descriptive statistics were used to summarize the demographic characteristics, clinical features and outcomes of the cases. The variables were also compared between survivors and non-survivors. The results were presented as mean ± standard deviation and percentage where appropriate. The t-test was used to investigate the differences of continuous variables between survivors and non-survivors. The relationships between categorical variables and the outcomes were evaluated using chi square test where appropriate.

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RESULTS

Out of 77 patients presented with acute paraquat poisoning it was 2.2 times more among males and about half of them were in third and fourth decade. Suicidal exposure was the single most important reason for exposure which is accounting for 91%. Most of the patients (52%) consumed more than the lethal dose of the poison ie., >40 ml. Many patients reported after critical time of >6 hours about 74%. paraquat is accounting for multiple complications and in our study we found that acute renal failure 45.45% , hepatic involvement 35%, Acute Respiratory failure 16% , GIT lesions 48%, circulatory failure 11%, multi-organ failure 22%.

Table I: Demographic characteristics of the patients

No of Patients	77
Males : Females	53 : 24 (2.2:1)
MEAN AGE IN YEARS	
< 20	7 (9.09%)
20 – 39	39 (50.64%)
40 – 59	21 (27.27%)
>59 10	10 (12.98%)
mean ± SD 36.04 ± 17.05	
PLACE	
Rural	56 (73%)
Urban	21 (27%)
REASON FOR EXPOSURE	
Suicidal	70 (90.9%)
Accidental	06 (7.79%)
Occupational	01 (1.29%)
AMOUNT OF PARAQUAT INGESTED	
< 20 ml	19 (24.67%)
20-40 ml	18 (23.37%)
> 40 ml	40 (51.94%)
DURATION IN HOURS FROM INGESTION TO ADMISSION	
< 6	19 (24.67%)
6-24	48 (62.33%)
> 24	10 (12.98%)
Acute Renal Failure	35 (45.45%)
Mean Peak Blood Urea	101±67.9
Mean Peak Serum Creatinine	4.25±3.93
Dialysis Requirement	18 (23.37%)
Hepatic Involvement	27 (35.06%)
GIT Lesions	48 (62.33%)
Respiratory Failure / ARDS	16 (20.77%)
Circulatory Failure	11 (14.28%)
Multi Organ Failure	22 (28.57%)

Table 2: Prognosis

Prognosis	Number Of Patients
Recovery	36(46.75%)
DAMA	17(22.07%)
MORTALITY	21(27.27%)
Within 24 hours of admission	6 (7.79%)
Time to death after ingestion (days)	7.81 ±7.9
CAUSE OF DEATH	
Respiratory Failure	09 (42.85%)
Multi Organ Failure	14(66.66%)
Shock	05(23.80%)
Hepatic Involvement	03(14.28%)
Acute Renal Failure	16(76.19%)

Patients with unknown outcomes (n = 17) who made their own decision to be discharged from the hospital were excluded from further analysis. Among the remaining cases (n = 60), 21 poisoning-related fatalities were reported, and these were predominantly male patients (61%). Most of the patients who did not survive had ingested more than 40 ml PQ (76.19%). Among the cause for mortality acute renal failure accounts for 76.19%, followed by multi-organ failure 66.66%, respiratory failure 42.85%, shock 23.8%, and hepatic involvement 14.28%.

The comparison between survivors and non-survivors with respect to the different variables outlined in Tables 3. The correlations between the variables and outcomes were evaluated.

Table 3: Variables in Survivors versus Non Survivors

Variables	Survivors N =39	Non –Survivors N =21	DAMA N=17
Mean Age	35+/-12	39+/-17	31+/-16
SEX (Male: Female) Ratio	2:1	1:1	2.5:1
Severity Of Poisoning			
<20 ml	16	1	2
20-40 ml	13	4	1
>40 ml	10	16	14
Duration To Admission			
< 6 hours	11	3	5
6-24 hours	28	12	8
>24 hours	NIL	6	4
Acute Renal Failure	9	16	10
Respiratory Failure	2	9	5
Shock	3	5	3
Hepatitis	14	3	10
Multi Organ Failure	2	14	6
Hospital Stay (Days)	11±7	14±9	5±4

DISCUSSION

Our results show that the mortality rate was high in PQ poisoning cases, which may be attributed to the large quantity (> 40ml) of 20% PQ that was ingested by our patients. The amount of the toxin, the PQ formulation and the circumstances in which the poisoning occurred are important factors in predicting mortality, as suggested by Pronczuk de Garbino (3). Although the mechanisms of PQ toxicity have been evaluated, no specific therapy has been shown to reduce mortality. (4) Paraquat is bipyridilium herbicide, which is inactivated by adsorption to clay in the soil (5). The toxicity of paraquat is through redox cycling, leading to generation of superoxide anions. These may react to form hydrogen peroxide and subsequently the highly reactive hydroxyl radical, which is thought to be responsible for lipid peroxidation and cell death. A second contributing factor to toxicity is the depletion of nicotinamide adenine dinucleotide phosphate (NADP) with bound hydrogen ion (NADPH), as both

paraquat redox cycling as well as hydrogen peroxide detoxification via glutathione is NADPH dependent.

The clinical course of paraquat poisoning depends upon the amount ingested. Initial phase of moderate to severe poisoning is characterized by reversible liver and renal failure [6, 7.]

We found Males are affected more often than the females (69%), as they constitute the working majority who are actively engaged in farming and other outdoor activities. Our findings concurred with those of earlier studies (8). In our study, predominantly the younger population (20-39 years) was involved (51%). These are the productive age group in the population. Their loss can be devastating to the family as well as the society. A majority of the victims were from the rural areas (73%).

We noticed that 19 (24.67%), reached the hospital within 6 hours and 58 (75%) of the patients had reached hospital after a delay of 6 hours. This delay in their arrival could be attributed to the poor transportation facility, lack of awareness of the hazards of PQ, which had contributed to a substantial increase in the morbidity and the mortality. In our study, majority of the exposures were Intentional 70(90.9%) mainly from deliberate self-harm, which may be comparable with study of Wong (9). Similarly, in a study conducted by National Poison Centre, suicide attempts were the most common circumstances of exposure with percentage as high as 73.8% (10). This shows that over the last few decades, suicide remains the leading cause for paraquat poisoning and the lifting of its sales ban is not addressing the issue but facilitating it.

In our study, the percentage of mortality in those who presented < 6hours was 21.4% and for those > 6hours was 39.1%. There was also no statistical significance between timing of exposure to presentation and mortality. This is likely because once ingested, it is rapidly absorbed and distributed to lung, liver, kidney and muscle where it causes damage as described above (11).

The mortality of paraquat poisoning remains high. Multi organ failure with circulatory collapse is associated with 100% mortality, early in the course of disease while late pulmonary fibrosis with respiratory failure also remains an important cause of mortality (12, 13, and 14). The survival rate in our study is 65%. On comparing the different variables amongst survivors and non-survivors, the severity of poisoning, late referral to hospital and multi organ system failure showed increased mortality. Because a high proportion of Indian population is involved in agriculture, the incidence of suicidal PQ poisoning is increasing as a result of easy access to highly toxic weedicides in the situations of stress.

Study Limitations
1. Our study is a retrospective study.
2. 17 patients out of 77 went against medical advice, which is accounting for 22%, so we could not able to follow up.

CONCLUSION
Paraquat is one of the most widely used weedicides globally and in most countries it is used without restrictions. However, some countries have restricted its use. Relatively few exposure studies and hardly any intervention studies have been performed.

This study concludes that, paraquat is a widely used weedicide by the farmers in the rural areas in and around the Hassan, suicidal ingestion is more common than occupational exposure in contrast to developed countries. Patient who has taken <20 ml and reported <6 hours shown better recovery in compared to their counter parts.

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